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John Osborn

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FROM this principle the Nature of Sleep, the effects of opiates, Spirituous Liquors & volatile Salts; & the origination & cure of all Soporiferous narcotick diseases, are easily understood & explained: of which I shall here give some general cases, including & comprehending all the rest.

1. When the heat & rarefaction in the Stomach, & its consequent distention, are moderate, such as may be occasioned by the heat of the fire after cold, an ordinary meal, a glass or two of wine, a good warm dram, &c. this turns the blood upwards with an accelerated velocity but in an easy equable, & uniform Stream: & hereby the pulse Strengthens, & animal life & motion are quickened & invigorated the vital fluid flows thro the veins, the blood-vessels in the brain are agreably & gently distended, and the nerves in their origin at the brain are put into a soft easy, undulating motion: and this by taking of any uneasy or painfull Stimulus, which might have been occasioned by watching, labour, passions, or too great evacuations, Strengthens & assists the operations of nature, at the Spring-head, & diffuses a warm invigourating pleasure thro the whole frame

2. If this afflux of the blood or vital tide to the head be increased somewhat farther, so as pretty strongly to dilate & distend the blood vessels in the brain & press upon those Nerves which are the organs of Sensation: the action of these organs & instruments of Sensation will be hereby weakened, interrupted, or quite suspended: according to the degree and measure of their compression by the turgid distended blood-vessels: and this will induce heaviness, drowsiness or Sleep.

3. When this drowsiness or Sleep becomes preternatural, from the aforesaid afflux of blood to the head, the distention of the blood vessels in the brain, & the consequent compression of the organs of Sensation being too great and too long continued: the consequence will be what we call a Lethargy.

4. If

4. If this afflux of blood be not so great as to produce a lethargy, but yet is longer continued in a more moderate degree; any such constant & too great afflux of a too great quantity of blood to the head, will separate a greater quantity of lymph or serum than ordinary, in the choroidal pineal, & pituitary glands, whose lymphaducts being hereby distended & at last broken, produces a dropsy of the brain, which is the most general & genuine cause of a palsy.

5. If the blood by this means be thrown with a strong, sudden, and violent torrent to the head, so as to break the bloodvessels, or stretch & distend them beyond the the contractive restitutive force of the nerves, y consequence is an apoplexy.

6. If this cause be somewhat remitted, & does not prove directly mortal, it often terminates in a confirm'd habitual epilepsy.

7. This afflux or tide of the blood being still brought a little lower, so as not to take away all sense & motion, but only to bear up the diaphragm & lungs, & hinder the immission of the air in a due quantity; especially when attended with [redacted] the like inflation & distention of the womb in women, will produce all the species & symptoms of strangulating convulsive fits and hysterick suffocations.

This generall morbifick constitution, proceeding from the various modifications of the vital tide, or afflux of blood to the head, will be much strengthen'd & the disposition towards it increas'd, by any organical disorder in the brain, either from the wrong conformation of its vessels, or some large hard and indissoluble tumour of any of its forementioned glands.

The same morbifick constitution is likewise generated, confirm'd & strengthen'd by the weakness, relaxation & flaccidity of the muscular

=cular coats of the Stomack and the foulne=
of its glands Stuff'd with a vifcid tenacious
lymph or Slime. For in the first place, the
nerves & blood vessels in the brain being
compress'd & too closely pent up, any Small
quantity of blood more than usual passing
upward, must have the greater & more Sensi=
ble effects, for want of sufficient room &
capacity of distention in the compress'd &
straightened blood vessels, & from the
weakness of the muscular coats of the Sto=
mach, any heat rarefaction & flatus of its
contents must the more forcibly distend &
blow it up, while the elastick restitutive for=
of its muscular Springs is not sufficient to re=
sist the rarefaction of the included overheat=
ed & expansive air: and the glands being
Stuff'd & loaded with a vifced Serum, or
Slime, retaining a great quantity of air, and
mixing with the meats & drinks in the Sto=
mach will very much contribute to encrease
& Strengthen the aforesaid rarefaction,
flatus & distention.

From this general account of causes the
chief intentions in the cure are plainly these

I. TO make a Speedy & effectual derivation
& revulsion of the blood & humours from
the head.

2. TO cleanse & Scour the glands & Secretory
ducts of the Stomach, by proper emeticks re=
peated as occasion Serves.

3. TO keep up an easy, free & open Secretion
by Stool

4. TO Open & cleanse the Small blood vessels
glands & lymphaticks of the brain from a=
ny dregs & recrements, to make way for ye
free circulation of the blood & lymph: and
this will be best done by mercurial deobstru=
ents: of which the cinnabar of antimony,
æthiops mineral, & the antihectick of Pote=
rius are principally to be regarded, joind
especially with black hellebore.

Specia

5. TO

5. TO Strengthen the muscular force & action of the Stomach by proper corrobbratives &c. the peruvian bark is the chief and stands beyond all competition against every thing else, in confirming a good digestion, and preventing the returns of any of these capital periodical diseases. But the more distinct consideration of what may be farther necessary — —

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II. TO explain the origin, formation & Constitution of Glandular diseases.

I. Therefore the urinary pipes and aqueducts from the Stomach & blood into ye bladder being the principal water-drain, by which the greatest part of the liquors taken in, are discharged again out of the body: when these are obstructed & the quantity of urine considerably diminish'd the necessary consequence of this, must be a surcharge of Serum in the blood which runing off to fast upon the glands & lymphaticks, & overstretching, dilating, & distending them, a dropsy must ensue; and from hence there will arise different appearances & symptoms, according to the different state & circumstances of the overstretch distended glands & lymphaducts, and the particular parts upon which the principal bulk & surcharge of the water is thrown.

The Melentery & caul being all glandulous & abounding with an infinity of lymphaticks, thro' which the largest quantitys of lymph are drawn off from the arterial blood, are therefore most liable & the first disposd to distention & tumefaction, upon any great & long continued obstruction and diminution of the urinary drains: from whence the inundation soon spreads, and distends the liver, Spleen, Stomach & all the parts of the Abdomen: & lastly the whole body is swell'd & bloated from head to foot.

But

But this universal Dropsy, or Anasarca is often prevented by a worse accident: for it frequently happens that the liver, Spleen, caul & mesentery, some or all of them, corrupting & their lymphaticks breaking, the water is let out into the cavity of the abdomen, &c. renders the case desperate: for tho' any present load of water may be let out of the belly by tapping, yet it will be still filling again from the broken lymphaticks.

But there is another sort of Dropsy, not lying more latent has been generally taken for a pure nervous case; — The Dropsy I here intend is ye internal hydrocephale, or dropsy of the brain. —

All the lymphatick glands of the brain thro which the lymph is drawn off from the ultimate branches of the cervical & carotide arteries, uniting in larger canals, convey their secreted lymph to the jugular veins, where it is emitted into the blood: & this is sufficiently evinc'd by injecting any tinged liquor thro the Infundibulum, where the lymphaticks of the brain unite: which liquor will freely pass into the jugular veins, but cannot in the natural State & Situation of the organs pass any other way.

When these glands & their lymphaducts are obstructed so as not to send off their lymph to the veins as aforesaid, the consequence is a dropsy of the brain: of which the Symptoms will be various, and more or less severe, according to the nature of the obstruction, & the quantity of the lymph detain'd & pressing upon the nerves & blood vessels: While the glands & their lymphaticks are only immoderately distended and dilated, but not broken the Symptoms are heaviness, lassitude and a general weakness of the muscels; a listless unconcernedness about

thing

things drouſineſs & an almoſt continu=
=all diſpoſition to ſleep with an unuſual
tenderneſs or incapacity of bearing the leaſt
exceſs of heat or cold either with reſpect
to the external air or the internal life of
drinks and medicines. When the obſtruc=
=tion & diſtention become greater the diſ=
=eaſe diſcovers itſelf in vertiginous & para=
=litick ſymptoms, & diſpoſes to lethargus,
epilepſys & apoplexys, & ſpaſmodick deſli=
=quia: But when theſe glands & lymphaticks
inflame break & let out their cruddled lymph
upon the brain, or between the Meninges, the
caſe is altogether deſperate, and the patient
ſoon dies paralytick convulſed and under
a ſtupid drouſy ſort of raving.

HOWEVER while the diſtemper is only grow=
=ing & before the lymphaticks break & extra=
=vaſate the water upon the brain, there is hope
of a cure, provided the moſt effectual me=
=thods are taken to derive & draw off the
water from the head, by long continued mo=
=derate purgings, iſſues, Setons, bliſters,
&c. but all volatile oily Salts, ſtrong
ſpirituous liquors, heating cordials & every
thing which determines the blood & hu=
=mours to the head are moſt certainly
hurtful.

2. BUT to conſider another effect of this
morbifick urinary ſecretion: It ſometimes
happens, that the primary drains, & thineſt
part of the urine, paſs of very plentifully
in ſufficiently large or perhaps too great
quantitys, while the groſſer Salts earths &
other thick & gritty recrements which
ought to be ſtrained off & diſcharg'd thro
the kidneys, are retain'n in the blood, from
ſome weakneſs, dilatation, or obſtruction
of the renal glands which cannot make
this due & neceſſary ſecretion. and this
groſs Salt & ſabulous matter being re=
=tain'd in the blood & mix'd with the ſerum
muſt paſs together with the lymph thro

the

the other glands & lymphatick Strainers in a preternatural way: & from hence the glands in different parts being gradually filled with this gross urinous Salt & Slimy Sabulum, will at length be totally obstructed, & very much dilated & distended with it, & thereby form various sorts of Atheromatous & Schirrous tumors which tumours, at last Suppurating and running into ulcers, produce a great variety of different Symptoms & appearances, more or less Severe & grievous, according to their Several degrees of malignity, & the particular parts affected: and this is what I chuse to call in general the SCORBUTICK constitution. Of which, these are Some of the principal modifications & phaenomena.

I. The Serum Serum of the blood being plentifully Stock'd with this gross, Salt & Slimy Sabulum, a great proportion of the thickest part of it must pass thro' the Spleen: in which the blood-vessels & lymphatick are the largest of any other glandulous organ in the body: and while the thinner parts are carried off, & the grosser lodg'd upon the glands, the Spleen will be first obstructed, indurated & tumified.

In the next place the mesentery, in wch. an infinity of lymphatick glands are interwoven, & complicated thro' its whole Substance, will be obstructed harden'd & tumified; and from this distention and tumefaction of the mesentery, the intestines must be compress & constipated, their peristaltick motion or the muscular action of their coats hinder'd & lessen'd & the protrusion & expulsion of the excrements obstructed: from whence the Stomach & bowels will be filled with a windy flatus, occasioning Sour, Sher

Sharp, acrid & stinking belches, cholic gripes, immoderate distention of the stomach & viscera, aftmatick Suffocations, and very often a sort of drunken delirious or maniacal strength & willness of imagination from the immoderate afflux of blood to the head. On the other hand while the intestines are thus compreſt by the tumified mesentery, any strong cathartick, lob, cooling, cleansing liquors, acid mineral oils & spirits, and whatever tends to move the blood & humours downwards by irritating & stimulating the stomach & intestines, which lost in a great measure loſt their muſcular natural force, muſt produce faintneſs, tremblings deliquia, a low pulſe cold sweats, & a terrified imagination, impreſt with all the images, and ideas of fear & grief.

The Spleen & mesentery to which we may add the Epiploon, being thus tumified & their glands obſtructed, the lymph cannot be drawn of in sufficient quantitys from the arterys; and the blood will be sent into the vena porta and to the liver, not sufficiently drain'd & depurated of its thinner serum: from whence the liver, inſtead of secreting the pure bile will drain off only a low, watery, salt & sabulous liquor coming near to the nature of urine: while the volatile oily salts of the true & natural bile will be left in the blood; & these mixt with the groſſer fixt salts & slimy sabula of the urine which cannot paſs the kidneys, ferment with & corrupt the whole serum of the blood, by rendring it hot sharp, acrid, pungent, extreamly penetrating, & in a manner corroſive: and the serum thus corrupted, muſt diſpoſe the tubercles & tumours of the Spleen & mesentery to suppurate and run on into putrifying ulcers: from which eroſion & ulceration there muſt enſue a Tabes, an hectick, & a general waſting of the fleſh & fat.

From all which it is plain, that this which has been here deſcribed is the hypocondriach & hyſterick conſtitution:

When this corrupted serum happens to be

thrown

thrown on the glands of the breast passages, produces tubercles, tumors & abscesses by the salivary glands, or an ulceration of the gums or both — in short there are no glands in the whole body but what may be affected after the same manner. The leprosy, the lues venerea, are owing to the scorbutick cause raised to a higher malignity.

To explain the origin & essential constitution of FEVERS in general.

In order to come at any certainty about the natural production, essential constitution and cure of fevers it will be necessary to consider those common symptoms which attend all fevers and by which a fever is outwardly & sensibly distinguished from all other diseases. Now these common characteristicks or visible appearances which in some degree or other attend every fever, are these which follow.

I. A quick, unequal irregular pulse.

II. A laborious & disturbed respiration.

III. An equally fluid, high coloured shining urine with a diminution of its quantity, especially in the febrile paroxism.

IV. A parchedness & dryness of the tongue, mouth & throat, with a clamminess and viscidity of the saliva, attended with a consequent heat & thirst.

V. An inflamatory painful restlessness, preventing interrupting, or disturbing the natural sleep.

VI. Loss of appetite and a general nausea and reluctancy of the stomach against every thing but thin diluting liquors.

There are three different & remarkable States

ers to be distinguish'd in eve-
Sharp, acrid &c. first is the State or period
gripes, inversation, while the heat & grave-
Stomach & the blood is still encreasing.
tions, the influx of the Serum thro' the lym-
deliriticks, more & more obstructed and
n diminish'd.

The Second is its constituent fixt &
Standing State, or that period in which
the fever having obtain'd its full growth
& perfect formation, retains its whole
form & constitution for a time, while
nature is employed about the most nice
& difficult work in order to bring about
a Salutary crisis.

The third & last State of a fever is the
Crisis, or that period in which the
blood condenses, dilutes & cools; and the
Serum taking its due course its due
course again thro' the lymphaticks, the
Stagnated corrupt or putrid lymph or
Serum is wash'd off, & thrown out in the
critical discharges of Sweat urine,
Stools, &c.

Tis evident from what has been already ob-
-serv'd that the first principles & original
Stamina of the disease are laid upon the
Stomach or intestines: where a hot inflam-
-matory flatus being excited, the business
of digestion is interrupted & perverted,
and the due Separation of the grosser and
more fluid parts of the Chyle prevented.
Now the consequence is, first, The mus-
-cular coats of the Stomach & intestines
being urged by the irritation of such
heated indigested matter, are hereby
brought into violent action, or excited
to very frequent & Strong contractions
by which means the indigested morbid
matter

matter lodg'd in the first passages, is thrown out of the body by a natu=ral vomiting, or purging or both according to the present State and disposition of nature.

2. During this [redacted] lucius & Struggle in the Stomach & intestines, the person by a loathing to solid food & such meats as re=quire much time for digestion, is forbid the use of them by the law of Nature: for while the Stomach with all its apparatus is thus in=disposed, nothing that requires much digestion can be taken in without detriment since all such things in this case must necessarily in=create that load of viscid [redacted] flatulent & indigested matter wch. nature is labouring to throw off.

3. Because while this is doing it must needs happen, that some of the viscid chyle must have made its way from the Stomach towards the blood, so as to begin the obstruc=tion in the chyliferous ducts, & the lymphatick canals of the conservatory glands: therefore nature takes care by the uneasy Stimulus of dryness & thirst which are the natural consequence of heat & rarefaction; to com=mand a timely abstinence from all heating fermenting liquors & to drink freely of such as are coolly attenuating & diluting with=out fermentation: And by this means the chy=liferous ducts are walh'd & cleans'd, the heat viscidity & rarefaction in the first passages supprest, the digestion restored and a free passage made for the usual drain & circu=lation of the lymph from the arterys to the veins.

And thus the first intention of nature is obtain'd, a crisis brought about, & the solution of the fever procured in the most safe & effectual way, before the disease comes to be perfectly formed, & fixed upon the animal System.

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If the perfect formation of a fever cannot be prevented & the first intention of nature obtain'd, but the disease fixes itself on the whole animal economy it will then have a certain stationary period natural & peculiar to it, and this stationary period is either employed by nature or ought to be employed by art in preparing & disposing the blood and humours for a regular crisis.

In this case Nature herself if too hasty ought to be restrained, as often as we meet with any large Symptomatical evacuations which are always attended with the worst consequences if not seasonably prevented.

During this period of the disease therefore, the physician is carefully & patiently to wait the farther directions of nature. However in the mean time the business of dilution is to diligently & carefully managed, — which will be best done by convenient drinks in sufficient quantitys, affisted with the testacea, sal prunel. vegetable & mineral acids, such as juice of lemmons, Spirit of Sulpher Spirit & oil of vitriol &c. in drinks & juleps: Still regarding with great care the habit, custom & constitution of the patient in his health, as well as the present case to know what degrees of cooling & dilution may be proper.

By this method a regular crisis may in due time be expected: the Serum of the blood which during the constituent State of the fever had been overheated & intimately mixed with the crassamentum now comes to condense, Separate & pass off as usual by the Several Secretions, both of the conservatory & expuratory glands. which is I think what ought properly to be called the Solution of a fever.

The Symptoms of which are some or all of those which follow.

I. A Sensible abatement of the heat or thirst, with a begining moistness and lubrication of the Salival glands.

II. A paler coloured & a somewhat thick or muddy urine, with a Sediment or Separation of its parts upon Standing.

III. An easy, cooling, periodical diaphoresis or Sweat, which is at the same time pretty sensibly Salt viscid & fetid.

IV. Viscous tenacious & black or otherwise discoloured stinking Stools.

V. Distinct periodical intermissions or remissions, where the fever was before continual, or with very irregular, imperfect or indistinct intervals.

VI. A pretty equal, regular & natural pulse, especially during the critical discharges.

As Soon as the Solution of the fever manifestly appears by these Symptoms, especially when the intermission or remission comes to be distinct, periodical & of any continuance the bark is presently to be made use of, and may be most rationally be depended on to secure a Salutary crisis. And it may be mixed up into juleps, boles electuarys or powders, so as to make it Solutive diaphoretick or diuretic according to the particular Secretions by which nature Seems most disposed to throw off the morbid matter.

In the intermissions or remission, when the foregoing Signs of Solution appear I order the following powder to be taken every three hours, or at any time between the fits, as the intervals will permit, where there is not time for Several doses between any two Succeffive fits.

℞ Cortic.

℞ Cortic peru. ℥ss. Coccinel. Rhub aa ℥i.
misce f. pulv. Divide in chartulas N° 12.

If this, as it sometimes happens, should have too great a disposition to pass off downwards, it may be altered thus:

℞ Cortic. peru. ℥ss. Rad. Serpen. Virg. ℥ss.
misce f. pul. Divide in Chartulas N° 12.

But indeed sometimes the Bark itself will will purge & pass off too fast, and in this case it will be most conveniently given in an electuary with Diascordium or Theriac. Andromachi, thus

℞ Theriac. Andro. Diascord. aa ℥ss.
Rad. Tormentil ℥ss. Cort. p. ℥ss. Misce.
& cum Syr. Cydon. q. f. fiat electuarium
Sumat 2. N. M. tertia quaque horâ

When I find the intermissions perfect, and the remissions long & distinct, so as to discover the last evanescent state of the fever that I may change & open all the glands in general, especially those of the kidneys, & secure a perfect crisis, I give the bark with the æthiops mineral or Cinnabar of antimony, or both together, thus;

℞ Cortic. peru. ℥ij. æthiops Min. Cinn. Ant. aa ℥ss. Rhabar. ℥i. Misce. fiat pul. Divid. in chartul. N° 12. Sumat ter quaterve in die.

Or if the form of an electuary pleases better, thus

℞ Conf. Absinth. Rom. ℥i. cinn. Ant æthiop. Minner. aa ℥ss. Cort. peru. ℥ij.
Misce & cum Syr. e chalyb. q. f. fiat elec.
ℨvaffaris consistentia Sumat 2. N. M.
ter quaterve in die ut prius.

While

While these are in use if need be, a purge or two may be given, & then the person advised to take the free & open air, and to set himself on some easy moderate exercise.

To assign the most general & remarkable Specifications, forces & appearances of fevers.

It appears from what has been before consider'd that a preternatural heat & rarefaction of the blood attended with an inflammatory dilatation of the blood-vessels & a consequent compressure and obtipation of the of the lymphaticks & glandular strainers, are in some degree or other the necessary constituents of every fever, with regard to its general nature & essential form.

Now tis evident that according to the different degree & quantity of these general causes, or rather essential constituents of a fever, there will be particular fevers generated of an higher or lower rank or degree, whose symptoms will be more or less numerous grievous & threatning, in proportion to the degree of force, and particular determination of these general causes.

Now tis evident that upon any increas'd heat & rarefaction of the blood, the globules of which the crassamentum consists, must swell, dilate & enlarge their dimensions: & being thus expanded in bulk they will imbibe & retain the thinner & more fluid part of the serum: but the thinner part of the serum being thus absorbd, and retained in enlarg'd & expanded globules, the remaining part of the lymph must necessarily be more thick & viscid: which viscidity must be encreas'd, in proportion to the increas'd heat & rarefaction of the blood. as is manifest by putting any portion of the serum over the fire, and exposing it to a moderate degree of heat, somewhat beyond the natural heat of the blood

blood; by which means, the greater part of the Serum will be visibly thicken'd, and turn'd into a Sort of viscid tenacious gelly. — —

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— — — Now in the first gradation, where the heat & rarefaction is such as only to Swell & dilate the globules, of which the crassamentum consists, without breaking dividing, & dissolving them. I call this a Flatulent fever, as being the effect only of rarefaction & inflation.

In the Second gradation, where the globules are in a great measure broken comminuted & dissolv'd, So as to induce the more grievous & threatning Symptoms, such as an extraordinary degree of heat, tumefaction & inflamation, extream drought, burning thirst a very irregular pulse, Sometimes exceeding high & at other times Scarce Sensible violent efforts & outrage, with other appearances which follow from a greater degree of heat & rarefaction, & a greater & more general obstruction of the glands, I chuse to call this State of the blood a colliquative fever.

But where there is a general & perfect Solution of the crassamentum, as to produce bloody Secretions, erosions, gangreens, hot burning tumors, &c. I Shall give this constitution the name of a Coagstick, Malignant, or pestilential fever.

Another general ground or principle of distinction & division in fevers, arises from the different determination of the blood in the course of its circulation, with respect to its afflux & reflux to & from the head, & extream parts or Surface of the body.

The blood in fevours is Sometimes thrown violently upwards & outwards, or deriv'd in too great a quantity or proportion, to the head & extream parts; which appears, in delirious, ravings, great Strength, an high pulse, and a burning heat of the flesh & extream parts; and at other times it is thrown downwards & inwards, thro the descending trunck of the aorta; while the

the head & extream parts are depriv'd of their due Share & proportion of blood, & left cold & languid, with a weak low pulse, loss of Strength, comatose dotings & frequent twitch=ings & convulsions of the parts: That is the Equilibrium of the blood in fevers is broken interrupted & disturb'd in the course of its cir=culation; & this happens by its being thrown in too great a proportion, either thro' the a=scending or descending trunk of the aorta.
Now the first of these general constitutions or perturbations of motion, I call an Efflu=ent, and the other an influent fever.

Now it is evident, that of the five febrifick constitutions the two latter may be various=ly mixt & complicated with the three for=mer.

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— — It may be worth observing, and wt. I can pronounce upon experience, that either in a peripneumony or pleurisy, the common famed bronchials, & celebrated pectorals, are of little or no use how much soever they may be cry'd up & depended on, but a deri=vation by blisters, & moderate cathartick, seldom fail under a judicious management,

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The Several Species & and appearances of le=gitimate original fevers induced from the heat & rarefac=tion of the blood have already been considered. But tis plain that any sudden condensation of the blood by cold increasing the attractive power of the globules, as the force & action of the expan=sive elements are diminished, must have a contrary effect, and dispose the Serum to pass off faster & quicker than ordinary thro' the glandular Secretory ducts; from which too quick & large Se=cretion there must ensue a Surcharge of the Secreted matter upon the glandular lymphaticks & aqueducts, occationing a painful distension & tumefaction of the glands thus affected: in wc. case the too quick & large Secretion from the over cooled condens'd blood continuing while only the thinner & more fluid parts of the Secretion pass off

off, the grosser & thicker parts of the lymph or Serum will lodge upon the distended dilated vessels & increase the inflamation & tumor till the obstructing matter be either dissipated & carried off by proper discutients, or brought to a Suppuration, & discharg'd by an abscess.

NOW from the general cause here assign'd, tis evident that various sorts of fevers may arise with different appearances, which will be properly Symptomatical of such inflammations & tumours of the glands, tho the blood be not otherwise at all overheated & rarified, but on the contrary chill'd and condens'd: and tho' the other Secretions continue regular & in their natural estate. All which fevers generally pass among the vulgar under the common name of colds.

—The blood being thus suddenly condensed, & its Serum thrown excessively upon the glands, as the condensing power of the cold happens principally to affect some times one part & sometimes another, a fever will arise from the inflam'd tumify'd eroded glands, & discover it self by some of these following Symptoms.

Inflammations, Swellings, Abscesses about the mouth, face, neck, & throat: hoarseness, violent coughs, great depression with a sense of weight upon the breast & difficulty of breathing: Sometimes at first vomittings & a diarrhea which are soon followed with an obstinate costiveness and a hard tensive tumefaction of the belly: cholick gripes, & Spasms of the Stomach & intestines: a low, unequal tremulating pulse: coldness in the extream parts, and a livid paleness of the face & Skin; extream drowsiness, & comatose Stupor; a paralytick deadness, & relaxation chiefly of one side. After which the patient dies convulsed, & under a Stupefied drowsy raving

All these Symptoms do not appear in all the fevers of this glandulous or condensative kind, but

but more or fewer, and with greater or lefs Severity, according to the degree & Strength of the condenfation the parts affected, and difpofition of the body. Where the diftenfion and tumefaction happens only on the parotid, jugular, or maxillary glands the fever is generally mild & benign; and eafily carried off by Sweating, & a blifter upon the neck: but if this has been omitted, as Soon as the principal tumor ripens & difcharges itfelf outwardly the fever for the moft part goes off, and all further danger is prevented by giving a purge or two.

But where the glandular inflation or tumefaction lies deeper in the lungs or breaft which may be known by the painfull troublefome dry cough, Depreffion of the breaft, & difficulty of breathing; in this cafe where the tumor cannot Safely be brought to an abfcefs and difcharged outwardly, Care muft be taken to divert the matter before it comes to an abfcefs: to which purpofe the moft effectual means is to apply with out lofs of time, a large Strong epifpaftick as near as may be to the part affected; and at the Same time to give, every three or four hours, a Small dofe of Some proper alexipharmick made gently opening. I have often found the following very efficatious,

℞ Lap. Contrayerv. ʒiii. Rad. Serp. Virg. ʒii. Rhabar. ʒi. Mifce. f. pul. Divide in chartulas № 12.

This may be made more or lefs opening, as the cafe appears to be more or lefs inflammatory, either by leaving out the Serpentaria & Supplying the compofition with Rhubarb & Sal prunel of each ʒifs. or by leaving out the Rhubarb, and puting the Serpentaria in equal quantity with the lapis Contrayerva.

The common drink may be mutton, veal or chicken broth, Sack whey, or tea made with Sage

Sage & buck-bean, adding a little white wine. But if the cafe be inflammatory, and attended with an effluent heat, an high pulfe & Spitting of blood, as it Sometimes happens, equal parts of milk & water boild together, and made into a thin emulfion with the pulp of roafted apples, are extreamly well addapted to the intention, & as a cooling opening pectoral, are vaftly preferable to all the famous pectorals of the Shops. But this morbid conftitution often lies yet deeper, & fixes chiefly on the inteftinal & mefenterick glands; & then it difcovers it Self by an hard tenfive tumefaction of the abdomen, cholick gripes, & Spafms, obftinate coftiveneſs, the Sinking of the pulfe, the retiring of the Natural heat, & the moft extream weakneſs & languor, while the patient is ſtill Senſible, without much of a coma or delirium.

In this cafe epiſpafticks muſt be applied with all their force, the Stronger alexipharmicks exhibited, Drinks impregnated with volatile oily Salts allowed, with opiates in Sufficient quantitys: that is, all proper means muſt be uſed to to take off the Stimulus to raiſe the pulfe & natural heat to derive the ſtream & efflatus of the blood outward, & thereby to prevent the too great & continued afflux of Sharp vitiated Serum upon the inteſtinal & mefenterick glands, which otherwiſe threatens a Speedy Excoriation, gangreen, mortification & death. Where this method in this cafe has been too long neglected all further attempts will be vain; for when the internal mortification comes on, the Strongeſt epiſpafticks will have no effect; but Soon after they are taken off, the fleſh under them becomes pale, livid & dry like the other Skin: upon which appearance, after bliſtering, the phyſician may Safely pronounce moſt certain death, and that the end of the whole tragedy is very near at hand.

There

6 There is yet a farther degree of this glandu=lar inflation & tumefaction, or quick and immoderate afflux of Serum upon the glands & lymphaticks; and that is, where the inunda=tion happens upon the cerebral glands, and the lymphaducts of the brain itself. In this case the drouſineſs, delirium, languid reſtleſſ=neſs, & paralytick Symptoms, increaſe in pro=portion to the riſe & progreſs of the obſtruc=tion, inflation & tumefaction of the cerebral glands and lymphaducts; till at laſt the glands mortify, or the lymphaticks break, & let out a deluge of water upon the brain, which ren=ders the caſe altogether hopeleſs &

In this hydrocephalick fever as I chuſe to call it the only method I have found to prevent the worſt, & effect a cure is by applying a large ſtrong epiſpaſtick to the whole hinder part of the head: — If this be done while the pati=ent is yet ſenſible, & before the comatoſe delirious, & paralytick Symptoms appear the bliſter for the moſt part runs well, & the patient generally recovers: But after the forementioned Symptoms come on I have never found a bliſter riſe, or produce any effect.

6 This ſort of fever or rather this degree of an acute glandular fever generally comes on with with vomiting & purging: as if nature in=tended to relieve her ſelf by that means, tho' theſe Symptoms quickly diſappear, and are ſucceeded by an obſtinate coſtiveneſs & the patient has no ſtools but what are forced. I am therefore apt to believe that an emetick & cathartick given immediately upon the firſt attack might be of great ſervice, but have never been call'd ſoon enough in ſuch a caſe. But this I know, that after the fever has fixed it ſelf for a few days, neither vomiting, purging, bleeding nor ſweating are of any uſe; but bliſtering, eſpe=cially on the head, in the manner already men=tioned is the only method I have obſerved of any good effect.

Both.

Both these two last mentioned gradations of an acute condensative fever, often meet together, & then their respective methods of cure must be jointly pursued.

Intermitting fevers or Agues, are a compound or mixed Species, participating partly of the arterial rarefactive, and partly of the lymphatick condensative kind: they generally people like glandular condensative fevers upon taking cold, and are especially nourished by a cold Saline damp & fenny air: they who are not used to such an air or to whom it is not natural & constitutional upon going into it & continuing in it for a time, seldom fail of catching these intermittents: which are sometimes very obstinate, & terminate at last either in the hydropical or Scorbutical habit: and run into such slow lingring & hectical fevers of the glandular kind, as commonly attend those constitutions.

Agues, as every body knows, begin with a cold compressive Shivering, &c. lasting for about an hour, sometimes more, sometimes less, is succeeded with an hot burning fever, of the arterial & effluent kind. The patient having been for several hours Scorch'd, & tormented with this feebrifick paroxism, he is at last perfectly relieved for the present by the irruption of large critical Sweats, after which all the Symptoms disappear till the fit return in the same manner, either the next day or with the clear intermission of one or two days. — During the cold fit, the pulse is quick Small & low, in proportion to the depressing condensing power of the cold; but afterwards it rises & strengthens proportional to the Strength & violence of the consequent fever. From the first attack, the

the person is affected with great thirst, extream Sickness at Stomach, nausea's & vomittings, which continue till the breaking out of the critical Sweats, and then are suspended till the next return of the fit.

These vomitings discharge considerable quantitys of a cold indigested Slime, or viscid Saline gelly, which is more or less mixed with bile: as to which, it must be observed that the bilious vomitings in agues, are the most salutiferous, & indicate the mildness of the disease; but where the viscid Saline gelly abounds the distemper is the more obstinate. And this is commonly the case in autumnal quartans, which are well known to be worst Agues.

Bleeding & purging are of no use, but for the most part extreamly prejudicial in Agues, since they are found to weaken the patient & strengthen the disease. Emeticks given that may have finish'd their operation a little before the coming of the fits, and Sudorifick's towards the end of a fit, to promote & help on the critical Sweat are of great Service; & by this means the Bark may be rendered effectual in the most obstinate ague, where otherwise the disease would elude the physicians care & skill.

It may be proper to observe, that Spring Agues, by which the congested viscidities collected in the preceeding winter are frequently thrown off, by the wise provision & good conduct of nature it self; and which are not likely, by reason of the ensuing heat of the Season, to sink the blood into any great degree of condensation, need not consequently be much tampered with by medicine; and indeed in this case, unless the physician be very prudent 'tis much if he does not do more harm than good.

But

But autumnal Agues, especially such as come on in August or September, upon a plentiful fall of rains, after great preceeding heats, & a Scorching Season; and generally all Agues at any time of the year attacking weak and languid people under Scorbutick, hypochondriacal or hectical habits, ought carefully to be observed & taken off as soon as possible. —

— — In weak low, & languid constitutions, where the apetite is lost, the digestion vitiated & depraved, the pulse sunk, and the natural heat exceedingly diminish'd from the weakness of the Stomach & intestines, the loss & diminution of their of their muscular elastick force, & relaxation of their coats; the Bark is the most efficatious Stomachick in the world. — — — —

— — In the intermissions or remissions of low glandular & condensative fevers, the efficacy of the bark is much raised & improved by Virginian Snakeroot, Saffron, cochineal & such-like warm Alexipharmicks, which well timed & proportioned will enable us to diffuse the natural heat, bring out the critical sweats, & procure a good solution & crisis; which otherwise could not be obtain'd by the bark alone. But on the other hand in the intermissions or remissions of effluent inflamatory, and highly rarefactive fevers, the Testacea fixd Salts & acids, ought to be joyned to the bark: or such cooling diluting liquors impregnated with these, as may hasten the condensation & solution of the blood, and bring on a timely crisis; which otherwise might be too long protracted to the great hazard of the patient, & disreputation of the phyfician. — — — —

— — — Whatever is intended to work upon the remote glands, ought to be carefully guarded

guarded; and its force & efficacy taken off upon the first passages, by volatile oily Salts & opiates, till it arrives at the principal Seat of it design'd agency. — — — —

But to return, after the fits of an intermittent fever have been put off by giving the bark in Substance, as usual, & its ejection by Stool promoted, by keeping up the natural evacuation by at least once in 24 hours: the most Sure & effectual way, is to drink the infusion in white wine twice a day, mornings & afternoons, for three weeks together; and for the poorer Sort of people it may be infused in Cider, or even in Small beer. — — — — — — — — — — — — — — — — — —

Experience has taught us not to give the bark in a febrifick paroxism; and tis commonly known that when it is thus given the fit is thereby protracted & Strengthned.

— — — — From a foregoing account of blistering, tis evident that their principal use is in lymphatick influent fevers, or Such as are commonly called depressing & nervous. But in effluent & highly rarefactive fevers where the pulse is Strong, & the external heat & efflatus very great, epispasticks are not to be applied, till bleeding in Sufficient quantitys has preceeded: lest by encreasing the velocity & effluent impetus of the blood too great before, the purples Should be forced out & a general mortification of the flesh ensue; but after the diffusive impetus of the blood has been Sufficiently moderated & restrain'd by bleeding, epispasticks will be of great use, to prevent the

the fever from changing its Species, & turning inward upon the Bowels; as it frequently happens, where the velocity and efflatus of the blood have been suddenly checkd by large bleeding, & no care taken afterwards to keep up & diffuse the natural heat, till a proper crisis can be obtaind.

Of Blood-letting.

1. In Strongly effluent & highly rarefactive fevers, attended with a Strong turbulent pulse, burning heat, delirious ravings, & Such a general outrage & efflatus of the blood, as to force out the purples, occasion bloody Secretions, & threaten an immanent haemorrhage & evasation of blood upon the brain: in this case blood must be taken off without delay, & that in quantitys Sufficient to Suppress the preternatural heat & efflatus; for if a Sufficient quantity be not taken off, it Serves only, by exciting a more violent fluctuation to render the case much worse.

2. In any great & apparent plethora of the blood vessels, blood must be Speedily taken off in a Sufficient quantity to answer the intention, for otherwise more hurt than good may ensue: & the natural Symptoms of Such a plethora are, great outward heats, high colour, lassitude, lethargick Drowsiness, asthmatick Suffocations, & a dull, heavy, dragging & Slow pulse.

3. In peripneumony's, pleurisies, & Such like adhesions of coagulated blood upon the principal organs, if the case is recent, and the

obstruc-

obstruction be not fixt too deep upon the glands it may be relieved by blooding, but in all such cases after the outrage of the blood is pretty well suppress'd by bleeding, the safest way is to apply Epispasticks in such a manner as to have their main effects as much as possible upon the parts chiefly affected.

4. In Apoplexies, some sort of Epilepsies & vertigoes, & in all cases which indicate a violent afflux of blood to the head so as to threaten an exsudation upon the brain a good quantity of blood must speedily be taken off, for it wou'd be loosing the patient to wait for the operation of any other remedy.

5. In extreamly pungent & acute pains, or stitches, which sometimes come on from a sudden windy efflatus of the blood in the small vessels, bleeding even in small quantitys is of great use? and I have sometimes known the patient reliev'd upon opening a vein almost as soon as the blood begins to flow.

But the mischief must be great where bleeding is perform'd under wrong circumstances: and generally in all great depressions & concentrations of the blood & humours in all deeply fix'd & radicated diseases, and in all such effects of of a sudden condensing cold, as often brings on the worst of fevers, bleeding can never be advisable.

Of Digestion. its Errors.

1. In a hot & flatulent digestion, the [illegible] concocted matter, instead of retaining its natural & due consistence, will run into

a frothy, hot, & windy flatus: And this must continually replenish the blood with an hot, rarefied & vitiated Serum, and be attended with all the consequences of heat, flatulency & viscidity throout the whole machine; Such as immoderate tention & inflation of the Stomach & intestines during the time of digestion, with hot flushing & shortness of breath, Sharp & Scalding fumes & belches, windy cholicks, restless watching nights, Specially after a late & plentifull Supper; periodical burning heats, a general indisposition to Sweating, unless it be Sometimes low, faintly Sweats; and a liableness to be overheated upon any little motion or exercise; with other Such-like effects of a too great quantity of hot rarify'd air, pent up & retain'd in a Slimy, viscous, & indigested Serum.

This error of indigestion is owing generally to intemperance & want of exercise: for very few, if any, are liable to it, but Epicures & idle Drones. The only means of recovery are, obstinate temperance & proper exercise: they who use this remedy will need no other. and Such as cannot comply are incurable.

2. From a defect of natural heat & where the dissolving power of the expansive Elements ~~are~~ is too weak, there ensues a cold & hard digestion. In this morbifick State of digestion, the volatile oily Salts, which ought to pass into the blood & be attracted into the globules, being left undissolved in the concoction, & precipitated with the excrements, the blood hereupon for want of this Supply, runs immoderately into Serum,

and

and looses its due proportion of Crassamentum; upon which the pulse becomes weak and low, the natural heat sinks, the nervous elastick fibers & springs of motion grow weak, soft & flabby, the person is dull, listless, and averse to motion; and all the animall powers as it were fatigued & jaded, droop, languish, and decline their work: And the blood being thus deprived of its richer oils & volatile salts, it will be carried to the liver too much abounding with Serum: in consequence of which the bile cannot be drawn off, or if which is drawn will come near the nature of common Serum, or water; & therefore not being able to perform its office, as a natural cathartick, an obstinate costiveness & obstruction of the bowels will ensue, and a continual nausea, loss of appetite, and inclination to vomit at every thing.

This error of digestion is often the consequence of the former, as the last result of it on the contrary extream; for nature being incapable of always bearing a continued tension, sinks at last into the opposite State as here described; and so the hot intemperence draws on the cold penance of nature.

Where this State of digestion has been brought on by a long preceeding course of luxury, drinking & excess, the case is extreamly dangerous; but what help can be [redacted] obtained, may be expected from emeticks frequently repeated, with an obstinate course of riding: to which may be join'd the intermediate use of the peruvian bark made somewhat opening with Rhubarb, & warming with winters bark, wild valerian, cinnamon, Serpentaria, &c. to which must be added the most resolute temperance, & abstinence from all Spirituous liquors.

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I have mentioned vomiting in this cold remiss State of digestion; & from hence may be taken the surest indication of the issue: for where emeticks work well & after a few repetitions produce some sensibly good effect, there may be great hope of recovery; but where they will scarce work at all, & the muscular coats of the Stomach & intestines have so far lost their elastick tone, that the emeticks lodge upon the first passages, and cannot be thrown off, but sink the natural heat still lower, it may be look'd upon as a mortal Symptom, & discourage all farther attempts.

There is one Symptom which I have frequently observ'd in those who have brought themselves into this morbifick State of digestion, by a previous course of hard drinking; & that is an obstinate, continued or fix'd pain in the Stomach; which is most sensible while the breast is rais'd for inspiration, & attended with great difficulty of breathing. After this Symtom has fix'd it self Emeticks dont work, & I never knew one recover.

But this error of concoction often comes on without any previous course of intemperance, and may be the consequence of immoderate grief, unwholsome diet, bad air, as it is the common case of girls under a Chlorosis.

3. It sometimes happens, that where the first concoction in the Stomach succeeds well enough, with respect to the degree of the natural digestive heat, yet by reason of an urinous Scorbutick salt secreted in the glands, & thrown upon the first

first passages, the consequent precipitation is too strong: from whence it comes about that not only the grosser feculencys, but the richer oils & volatile salts of the concoction are precipitated & thrown off with the excrements; & this from the too great Stimulus occasion'd by these Scorbutick salts, mix'd with a sharp acrimonious Serum.

People of this constitution eat plentifully and with a keen appetite, and yet are not nourish'd or strengthned by it, but continue thin, lean & meagre, and with pale complexions & hollow eyes, look as if they were half Starv'd. They have an almost continual grating or knawing at the Stomach, and seem always empty but when they are eating: their blood is generally low & poor, that is, Serous & watry; they make but little urine & are for the most part costive; they are apt to Sweat, & are much relieved by it, because this carries off part of the salts & Serositys of the blood, which cannot pass by urine, & diverts their course from the Stomach; they are impatient of abstinence or fasting, & tempted to eat more than they can digest or carry off: to which a great part of the disease is doubtless owing, for light meals tho' the oftener repeated best agree with them: they cannot bear strong liquors, even in an ordinary quantity; for tho' they often do want such recruits, yet a little will over heat & dry them up: and finally, when this morbid State is left only to Nature, unless good brisk exercise and great temperance prevent it, it terminates in a dropsy.

This constitution is evidently a Scurvy, fixing it self upon the Stomach: The most certain & Specifick remedies are the

the mercurial & antimonial prepara-
tions; especially the athiops, Cinnabar of
antimony, Diaphoretick antimony, Bezoar
mineral & the antihectick of poterius:
any of these given with winters bark &
wild valerian, or with Rhubarb & black
hellebore, as the constitution is either
hot or cold, will evadicate the disease.

Of Opium.

The first & most sensible effect of Opium,
when taken into the Stomach, is a certain
agreable sensation, or entertaining amu-
sing pleasure which it excites, & which seems
to diffuse itself throout the whole animal
frame: of which pleasure, the first & most
sensible impressions are made upon the
Stomach, Oesophagus & bowels from whence
it soon ascends, & affects the brain. Du-
ring this effect of opium, the thoughts are
thrown into an agreable confusion, & the
mind is taken off from all other objects &
concerns, to attend the present pleasurable
impressions upon the nerves: in this state
of extatick quietude, the pulse rises and
beats quicker & ~~higher~~ stronger, the natu-
ral heat is diffused, and the vital tide vi-
sibly rises & strengthens, with a natural
easy afflux to the head: in consequence
of which, the cervical & carotid arterys
being filled, & moderately distended with
blood, and pressing upon the Senforys and
Springs of motion in the brain, their action
is hereby suspended, that is, the person
is reduced to a State of Sleep.

If the quantity of opium be given be
some-what less than enough to induce
a sound Sleep, it affects the person only
with the foregoing pleasant confusion of
ideas,

ideas and entertains him with a thousand
pretty vagrant phantoms and agreable
images, as in a dream, or betwixt Sleep
=ing & waking. But if Opium be given in a
still lower dose, it Serves only to Strengthen,
animate & invigorate, and to fit a man for
the neceſſary offices & requirements
of a State of waking & exercise: like a mo=
derate quantity of wine, an enlivening dram,
or any Such Sort of agreably warming li=
=quor. And thus its effects gradually riſe
from a pleaſing, Strengthning invigoration
to a deep & Sound Sleep: which Sleep, if the
doſe be too Strong, may happen to be lethar=
=gick, Apoplectick, & incurable.

These are the moſt general, conſtant
& peculiar effects of Opium: Which effects
(by the way) are confin'd, for the moſt part
if not wholly, to the inward uſe of it; tis
true indeed that opium when outwardly
applied, in plaiſters, lotions, unctions, &c
has a mighty efficacy in taking of an infla=
=mation, eaſing the pain of a Suppurating
abſceſs, and diſcuſing of windy & flatulent
tumors; and to theſe purpoſes I have ever
uſed it with great freedom & with equal
Succeſs: and the conſiderable quantitys
of the moſt Subtile active parts of it muſt
paſs into, & circulate with, the blood: yet
I never obſerv'd any direct Soporiferous
effects from it thus applied, but the Sleep
which Sometimes follows Seems to be pure=
=ly natural, & the conſequence of a relief
from pain.

The peculiar & moſt directe effect of opium
being to check & reſtrain any violent
Stimulus, or to forcible impreſſion of motion
upon the nerves: tis manifeſt that the un=
=reaſonable ingudicious uſe of it muſt do a
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great deal of mischief: for by this means it must gradually weaken & destroy that Elasticity of the fibrilla, which is natural and necessary, suspend & lock up the natural evacuations, diminish the velocity of the blood, and at last induce a general stagnation of the animal fluids, for want of sufficient force elastick to keep up and carry on their motion & circulation.

Where any such injudicious use of opium has induced a too great quietude & fixation of the nerves, & a consequent viscidity and cohesive lentor of the fluids, sticking upon the glands & cloging the principal springs of motion: the best restoratives, & most effectual means of recovering such an impair'd constitution, will be a keen, dry & strongly elastick air, cold bathing, water drinking, often riding & daily exercise, frequently repeated vomits, ratio aromatick bitters, and the milder & safer preparations of mercury & antimony, made opening with rhubarb and especially join'd with black hellebore.

Those bowels & organs which are supply'd with blood from the descending trunk of the aorta are liable to be clog'd & overloaded with a too great weight & impetus of the blood & lymph; especially after long watching, hard labour, great cold, immoderate grief &c. to remedy which while the injury is recent opium has a most certain & prodigious efficacy: and this it does by railing the vital tide, quicking & strengthning the pulse, and diffusing the natural heat, after the manner already explain'd.
But then if too much indulg'd, besides the general ill consequences already mention'd it disposes to lethargy's, apoplexy's, vertigoes, blindness, & the most spasms or convulsions of the head & stomach, and all the diseases

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which are induced by Strong drink.

In all condensing colds, which throw the lymph & Serum immoderately upon the [illegible] glands; in violent coughs begining consumptions; & all injuries of the bronchia; while they are recent, & before the glands are too much loaded & the obstruction obstinately fix'd, opium, under a carefull management, is extreamly beneficial; but tis seldom to be trusted alone. For when the Serum begins to be thrown off from the tumified obstructed glands, Nature for the most part, endeavours presently to discharge the vitiated lymph into the Stomach, in order to be thrown out of the body that way. and this soon discovers itself by naufeas, loathings, and an inclination to vomiting: vomits therefore in this case are plainly indicated, & in fact Scarce ever fail to answer the intention. But where any disease of this kind is too far advanc'd, opiates are hurtful

There is one particular case in which opiates are of excellent use, & that is the case of child-bearing women, who are often tormented for many days together & sometimes for several weeks, by turns with slow, lingring, grinding but ineffectual pains; by which nature is frequently weakend, and depress'd to such a degree before the great exigence that She sinks at last under the weight & burden of the work: Besides the child having been long stimulated & pain'd, grows still weaker, and is many times by its efforts under the pain entangled & thrown into a wrong position, so as to render the future birth impracticable, without great violence... In this case opium is the only safe effectual remedy; and a noble pacifier of the mother & infant: nor need any one fear left by this means the naturall time

of

of the birth Should be protracted & injury done that way; for when the pains come in earnest, & to good purpose, they will easily explain their nature & design, and the Speedy event will put the whole matter out of doubt.

But moſt pernitious is the practice of thoſe who at the Supposed time of delivery, give what they call Forces to haſten on the work; by which nature being forc'd upon an unreaſonable Stretch, the birth precipitated & the ligaments violently torn off: an Hemorrhage often enſues, with a fatal criſis, which leaves no further work either for phyſician or midwife: but even at this Season, if ~~nature~~ neceſſity requires it, a moderate doſe of an opiate given, that nature may have a little time to breath, & to wind up the Springs of motion, in order to renew the work with freſh efforts, is certainly the Safeſt & moſt rational way.

What has been Said of the lingring ineffectual paines before the birth may be equally underſtood of the pains after the birth, which when Sharp, intenſe & violent muſt be effectually relieved by opiates in Sufficient doſes; this not being done, a fever often enſues, more perilous than of labour, & in which the greateſt labour is yet to come. And indeed when opiates are given, So far only as to take off the pain, & recover the elaſtick tone of the overſtrain'd veſſels, nothing can be more effectual to bring off the afterbirth & promote the neceſſary cleanſings, whatever Some may imagine to the contrary: but when the pain is remov'd & the Strength a little recover'd the opium has done its work by anſwering its proper end; and then any mans reaſon will tell him it ought to be laid aſide.

TO.

To explain the morbifick Constitutions, as depending on the different State and disposition of the blood.

The blood differs in different persons, and in the same person at different times, with respect to its Quantity, Velocity, Flexility, Density, ~~& particular determination~~, Serosity, Solubility, and Direction, or particular Determination.

Tis difficult to determine exactly the quantity absolute of blood in an human body. And besides it cannot be doubted but the due quantity of blood is very different in different constitutions, and under the various circumstances of animal life. Women and children have proportionably more blood y^n men; & in general, the more soft, delicate, & tender the constitution, the greater is the quantity of blood & fluids in proportion to the Solids.
But this is a Speculation of no great consequence; for tho' the absolute quantity of blood cannot be determined, yet the relative quantity, as defective or redundant. (which is all the physician is concerned about) may very easyly, and the Symptoms of repletion or deplation are so obvious they need not be insisted on: only it will be necessary that a physician be very cautious that he does not mistake every occasional flush or tide of the blood to the head for a general plethora of the blood-vessels.

The morbifick excefs of the or defect of the bloods velocity can only be judg'd from the natural State of the pulfe in health which is different in different conftitutions: the ordinary number of pulfations in a minute is from 70 to 80, under a State of waking & moderate heat: and from 80 to 96 during the time of Sleep.

The velocity of the blood (to which its momentum is proportional) is ever in a ratio compounded of the frequency of the pulfe & the magnitude or quantity of the Stroke.

Therefore they are much miftaken who fuppofe a quick pulfe always indicates an encreafed velocity of the blood, & Vice Verfa: and they alfo who have defined a fever by an encreafd velocity of the blood, for nothing can be more manifeft to experience than that the velocity of the blood may be encreafd extreamly without a fever; and on the contrary, this velocity during a fever, is often very much diminifhd as appears from the weaknefs of the pulfe tho' it may be very quick, & even tremulateing.

There is one very remarkable difference of the pulfe, which it may be neceffary to obferve here; and that is the diftinction between a large or full, & a thin or Small pulfe: either of thefe may be Strong or weak, & by a reciprocal proportion may fo ballance each other, as to retain the Same magnitude or quantity of the Stroke in both; that is the velocity of the blood under a large, full, and weak pulfe, may be the Same as under a Small, but Strong and Smart pulfe.

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The coats of the vessels being sometimes very much distended by the great quantity of blood thrown into the arterys at every Systole, the pulse hereby becomes Slow and the blood undulates thro the vessels, in a full Swelling but Slow tide. This is commonly the Apoplectick & lethargick pulse. & the same kind of pulse discovers it Self in the pleasurable passions, especially those of love & joy, when very Strong & Sensible; & in a very Sudden excessive emotion of joy the pulse rises & Swells extreamly, & then Sinks all at once, and the person Sometimes expires in a Deliquium.

On the other hand, a very thin & Small pulse is often extreamly Smart & Strong, & the blood is driven Swiftly forwards while the contractive power of y^e^ nerves is very great, So as to resist any great distention or enlargement of the blood-vessels: And this Sort of pulse may generally be observ'd in madmen, and in those who acquire an extraordinary Strength & activity, when made desperate by a fright, or Set upon action by the appearance of Some present pressing necessity for Self-preservation.

Another different State of the blood, is its greater or lesser degree of fluxility or viscidity, for it may be too intimately separated, divided, attenuated & fluxilized: or on the contrary there may be a too Strong & close a cohesion of its parts, So as to render it thick & tenacious. The first, disposes the blood to a too quick, easy & rapid motion, & Sometimes fuses it to Such a degree as to occasion bloody Secretions as in malignant fevers; but the viscid State of the blood renders it unapt for motion, & disposes it to Stick &Ooze upon the Smal vessels. And

Another different State or disposition of y^e blood, depends on its Specifick gravity, or the various degrees of its rarefaction and condensation. This constitution depends entirely on the several degrees of heat in the blood; for as the heat rises or sinks too much, the blood will be rarified or condensed too much; and the consideration of this is of great importance to the physician. For where the blood is over-heated & rarefyd, the expansive force of the elementary fire & air contained in the mass, prevails over the corpuscular attraction; & then by the coagulating power of heat upon the Serum, & its too intimate mixture & cohesion with the crassamentum, the lymph which should form the Secretions cannot be separated, wherefore the natural Secretions must be diminished. Now in this case, if the expansive force of the heated blood, be too Strong for the contracting power of the nerves: the Equilibrium of the circulating blood will be broken, & the lymphatick Secretions extreamly lessend or quite suspended, and a fever must ensue, of some sort or other, & more or less inflammatory, according to the degree of heat in the blood, & consequent interruption of the lymphatick Secretions. But if by some violent passion, or other Stimulus upon the nerves, their contracting restitutive power is preserv'd, So as sufficiently to resist the the expansive force of the rarified blood; the lymph in this case will pass of in a greater quantity, tho in a quantity less than what is necessary natural: the consequence of wc. will be a mania, or madness, which is phren

phrensy or delirium without a fever.

The opposite constitution to this, is where the blood is immoderately cooled & condensed: in this case the corpuscular attraction prevails over the expansive force, & the Serum being hereby being over-thinn'd & fluxilized is separated too fast, and thrown off too fast upon the glands & lymphaticks: now from hence if the urinary drains happen to be obstructed, a Surcharge of lymph upon the glands & lymphaticks must soon be the consequence, & a dropsy will ensue. But in case the fluid parts of the urine pass freely enough, and only the grosser Salts & recrements are kept back, & these thrown on the Several organs, will produce the Several Symptoms of a Scurvy: as already explain'd.

The constitution of the blood differs also with regard to the different proportion of the Serum & Crassamentum, in the mixd mass.

The Crassamentum which Subsides in the porringer when blood is drawn off, is generally $\frac{1}{2}$ of the whole mass; and where it is found in a proportion very different from this, whether in excess or defect the constitution becomes morbifick. And because the principal heat, vigour and efflatus, of the blood consist in the crassamentum, the heat of the constitution may be judg'd of from the proportion of the Crassamentum to the Serum. 'Tis true indeed, that where the quantity of the Crassamentum very greatly exceeds that of ye Serum, & but little Serum will Separate from the blood by long Standing: the constitution will be weak, & all the animal powers low & languid: yet Still a continual heat troublesome, great difficulty of breathing,

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and hot Suffocating inflammatory pains coming on by any little motion or exercise will be the constant Symptoms & Indications of such a Disposition of the blood.

On the other hand, an excessive quantity of the Serum, in proportion to the Crassamentum, brings on, or disposes to all those diseases, which are attended with a Sinking languid, debilitating coldness of constitution.

By Solubility of the blood, I understand the disposition of the Crassamentum & Serum to separate & disengage from each other, when the blood comes to stand & cool in a bason.

Tis well known that when blood is taken off it must frequently stand a long time at rest & in a cold place, before its principles can disunite, so as to effect a perfect Separation, & yet at last when the Separation is made, there may be a Sufficient quantity of Serum, and perhaps a greater proportion than ordinary. whereas at other times this Separation shall be quickly made, and the Solution effected in a shorter time of Standing, & in a warmer air. And the principal reason of this difference, is plainly the different degrees of heat to which the blood is Subject, the globules being much more rarefied & expanded at one time than another: So the arterial blood is longer Separating than the venal; and in an high inflamatory fever, the venal blood requires a considerable time of Standing in a cool place, before it can throw off its Serum. but in a cold condensative state of the blood, this Separation is procured almost presently: for tis plain, the more the globules are heated & expanded, the nearer they will come in Specifick gravity to the Serum & the less will be their corpuscular attraction.

From this difference in the Separation of the Crassamentum & Serum, the different proportion of the attractive forces & expansive, and consequently the different degrees of the natural heat in fevers & other diseases may be rationally judged of. And this shews

Shews of what consequence it is to the physician, in most cases, to take at first a little blood that he may be enabled to judge of its State & constitution whether there be any other occasion for bleeding or not; for as this can be no harm, so it may often be of great use.

The consideration of different directions or determinate motion of the blood circulating is a matter of great consequence. — All physicians know to what great irregularitys the blood is liable in its different direction & determination, and enough has been said already of that great & remarkable difference in motion & direction of the blood with respect to its afflux & reflux to & from the head. Any considerable Stimulus will derive the blod in larger quantitys to the Stimulated part, which must break the equilibrium & uniformity of its circulation

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To Cool, dilute, & attenuate the blood.

The too great heat & viscidy of the blood is one of its most prevailing morbid constitutions, especially in such a luxurious country as ours: for this morbid State of the blood is certainly brought on for the most part by drinking too ~~largely~~ freely of hot Spirituous liquors, feeding plentifully on flesh meats, & all hot, spicy & high-seasoned broths, Sauces, or other foods.
This morbid State of the blood, and all its evil Symptoms are exceedingly heightened and aggravated by a Sedentary life, or the want of Sufficient motion & excercise.
From this account of the case, tis evident that temperance & excercise is necessary to the cure.

Among

Among all liquors, water is the most effectuall to cool & dilute the blood & to preserve the animall fluids in a due State of fluxility & motion.

The proper time for cooling & diluting the blood, is in the morning or before dinner. And to wash of the viscid excrements collected during the time of Sleep, diluting in the morning is of the greatest consequence, & what ought not to be dispenst with by those who have a just concern for their health. To which purpose a large glass or two of good soft water from marley or chalky Springs, drank first in the morn, a breakfast upon watergruel milk-porrage or green tea or some such like cooling diluting method is exceedingly beneficial; and such as begin in the morn upon drams are advised to settle their affairs.

What has been here said is chiefly to be understood by way of prevention in those who have hitherto retain'd a tolerable State of health. But where this morbid State has been long fixt, & deeply radicated till the lymphaticks & glandular recesses are strongly & obstinately obstructed, all the cooling & diluting in the world by any of the common methods will be insufficient: here there some effectual deobstuent must be made use of: and I know of but one sufficient, and that is mercury; the milder preparations of which, given in moderate doses & long continued, will so as not sensibly to affect the Stomach & first passages, nor procure any considerable sensible evacuation, will do wonders, in all glandular cases.

The mildeft preparations of Mercury, and Such as will not Salivate at all, as Aethiops Cinnabar, or the like, when gi=ven too faft, or in too great quantity, are often attended with very bad Con=fequences, as lofs of appetite, violent cholicks, diarrhea's, eroSions of the Sto=mach, inteftines, &c. and all theSe ill conSequences are Still more dangerous from its Stronger preparations, when given after the Same manner.

In any courSe of mercurials, diuretick are of great Service: And indeed where this Secretion Succeeds right there is Seldom need of any other; for by this means the Stomach being kept clear and free, there will be no great neceSSity for vomiting, which otherwiSe ought not to be diSpenSed with, unleSs Some peculiar Symptoms or apearances forbid it.

The various effects of mercury, and its Several curative intentions, are very much promoted & differently determined by the four following Simples; namely Guaiacum, roots of wild valerian, black hellebore & rhubarb: of which it may be obServed that the Guaiacum & wild valerian have a peculiar efficacy in throwing the matter of any glandular diSeaSe outward, & ter=minating it upon the cutaneous glands; where it is much better managed than when it falls inward upon the Stomach, inteftines & glandular organs of the ab=domen. On the other hand the black hellebore & rhubarb have a particular efficacy in precipitating the matter of any glandular diSeaSe downward, & carry=ing

carrying it off thro' the urinary discharg=es. But this may be especially remark'd concerning the black hellebore that where it is mix'd, or compounded with the gum Guaicum, wild valerian or any thing else of a warm & effluent na=ture it serves to promote perspiration or a discharge thro' the cutaneous glands more than any thing else that I have ever met with. I have mentioned the Guaicum & wild valerian to the purpose aforesaid; tho' indeed the Serpentaria & Saffron, are more quick & powerfull to y^e same intention: that is their effects are the more sensible, & are therefore in some cases preferable to the other, as will afterwards appear; but the Guai=acum & wild valerian have a peculiar efficacy in dissolving attenuating & throwing outwardly the matter of glan=dular diseases.

If any one should ask the reason of this, I must own that I know nothing of it but only from experience, which plainly evinces the matter to be so in fact, and this is perhaps the only reason that can be given for the peculiar characteristick effects of the Bark opium, or any other medicinal Simple.

To retain the Equilibrium of the circulating blood, against the frequent occasional afflux=es & refluxes of the vital fluid.

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The general intention of raising & diffusing the vital fluid, as abstracted from all other Symptoms, is best obtained by the Seypentaria Viginiana & Saffron, Opium has likewise a very great force & efficacy this way, but in all great & obstinate obstructions of any of the principal organs, Opiates are to be cautiously & sparingly used, with the regulations & restrictions already laid down.

The contrary intention of depressing & repelling the blood (when it happens to be raised & diffused with a too great force & impetus) may be easily obtained from the testacea, Sal prunel, Rhubarb, & all cooling diluting liquors. Bleeding also & glisters are very efficacious to the same intention; but the former ought to be directed with greater nicety & care than is commonly imagined. Acids likewise of all Sorts as juice of lemons, Spirit of Sulpher, &c. in juleps & draughts, serve very well to cool condense & repel the overheated effluent blood.

But I cannot here forbear mentioning, & doing justice to one thing, which perhaps may be slighted because it is too common. I mean Apples, especially the gratefully acid & oily Sort such as the Kentish pippin, pearmain, pomeroy

pomeroy, nonparelle, &c. these are moderately cooling, diluting, attenuating, cleansing & balsamick: the condense & precipitate the matter of a too hot & flatulent digestion, cool & refresh the Stomach & bowels, attenuate & propel the faces, & promote a most natural & benign evacuation by Stool. In short under all hot, flatulent & rarefactive disorders [redacted] of the Chyle lymph & blood, they are an excellent Stomachick pectoral, & diuretick.

When the blood in this interrupted aquilibrium is various & differently determined, Sometimes one way & Sometimes the other, the Simples under each intention must be variously mix'd & compounded, accordingly; of which the physician will be only capable of judging by a carefull consideration of the Symtoms & present appearances.

To recover and maintain a due proportion of the Craffamentum and Serum in the Blood.

By indulging the too free & plentifull use of Such meats & drinks as abound with rich oily Sulphers & volatile Salts, the quantity of the Craffamentum is immoderately augmented: and this occasions a hot flatulent digestion, & disposes to all Such diseases as proceed from heat, flatus & rarefaction.

Here therefore the best method of cure is to live Soberly & temperately, to feed

Sparing

Sparingly on flesh well boild or roasted with plenty of garden Stuff. to forbear all excess in hot Spirituous, fermented liquors. & to use a cooling diluting method, by drinking water, green tea, eating watergruel, milkporrage, milk & apples &c. especialy in the morning: for this may be taken as a certain rule that the morning is the proper Season for diluting & the evening for chearing invigourating and raising the animal constitution if need be, after the labour & fatigues of the day.

There is another method of lessening the Craffamentum, where it too much abounds in quantity with respect to the Serum; and that is by frequently repeated bleeding in Small quantitys. For the Craffamentum being a Standing quantity like the fat, tho this part in bleeding is drawn off proportionally with the Serum, yet it will not be recovered afterwards in the same time: and therefore by frequent bleeding the quantity of the Craffamentum will be diminished, & that of the Serum proportionally increasd. But it must be observ'd that the intention of lessening the proportion of the Craffamentum by bleeding cannot be obtain'd, where the lymphaticks are broken in a dropsy, So as to let out the Serum into the cavitys of the body. for here tho the proportion of the Craffamentum be too great, yet the absolute quantity of the blood is exceedingly diminished by the continual drain of lymph into the cavitys of the breast & abomen, And therefore tis plain, bleeding in this case must be hurtfull.

What has been here said of a dropsy, may be equally understood of any immoderate evacuation in which the Serum being thrown off too fast, the proportion of the Craffamentum will be too great, while the quantity is diminished; in all which cases bleeding must be very prejudiciall, and y^e only

only true method of cure will consist in Stopping or restraining the preternatural evacuations.

By a too cold & Slow, or a too quick, precipitated & Scorbutick digestion the proportion of the Crassamentum to the Serum will be preternaturally diminished, while the blood in its absolute quantity continues the same. In this case to restore the natural proportion of these two principals in the blood the error of Concoction must be corrected which arises either from a defect of the natural digestive heat, or from a Scorbutick taint fix'd upon the Stomach or from both these variously mixd & joyn'd together. The method of cure may be collected from wt has been said already about digestion.

To Strengthen and keep up the Elastick tone, or muscular force of the nerves.

The nervous elastick fibrilla are Subject to two contrary indispositions, for either they may be Stiffend, hardend & contracted, So as not to be capable of Stretching by any ordinary force; or on the othey hand they may be Stretchd & relax'd beyoad their natural tone, or capacity of contraction. The Soft lax & flabby State of the nerves is brought on by all the methods of luxury, excess, & indulged reft or inaction, from whence the fluids contract a viscidity, and are immoderately accumulated on the obstructed distended glands. by which is induced a weak feble enervated constitution. This is likewise the natural disposition of Children in whom the fluids bear a great proportion to the Solids. and women are coteris paribus, more liable to it than men. The contrary State of ~~crimps~~ Stiffness, rigidity and inflexibility of the nerves & motive fibrilla,

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is brought on by exceſſive exercise & great fatigues, immoderate watching, too great evacuations; and by all the drying emaciating paſſions, as anger, revenge, envy, malice, madneſs & exceſſive deſire in every thing. This is likewiſe the natural diſeaſe of old age. &c.

To promote & keep up the natural evacuation or Secretion by urine.

From what has Said already, it is evident that this intention is of the utmoſt importance to health & long life: that moſt Chronick diſeaſes are owing to a want of a due & regular Secretion by urine. & conſequently that a numerous train of Severe evils may be prevented by a juſt regard to this neceſſary diſcharge. Now the obtaining this intention will depend upon conſidering duely the different State & circumſtances of the general caſe.

1. As to thoſe who have indulged a method of hot intemperance, till they have overraiſed & heated the blood & contracted a flatulent digeſtion: the moſt effectual diureticks to them will be water, green tea, apples, milk & apples, or a thin Emulſion made of the pulp of roaſted apples with any cooling diluting liquor: eſpecially if Such a method be conſtantly taken in the morning, which will be the moſt effectual way to throw off & diſcharge any Such viſcid lodgments upon the urinary glands as had been attracted and accumulated during the time of Sleep.

2. In cold low & languid conſtitutions, where the Secretion is leſſened from a diminiſhed velocity of the blood, infuſions of horſradiſh, Muſtard & gromwell Seeds, millepedes, a few drops of the balſam of capivi, & Such warm Stimulating diuretick

diureticks mix'd with diluters, will be moſt effectual.

3. When the urinary glands are very much ſtuff'd & loaded with gravel, or any ſabulous matter which cannot be thrown off by any of the common diu=reticks, recourſe muſt be had to canthar=rides; which given in ſmall quantities not exceeding five grains, and well di=luted with any thin ſoft & milky li=quor, is beyond all diſpute the moſt powerfull & effectual diuretick in the world.

4. When the urinary glands & paſſages are ſcorbutically affected, dilacerated & eroded, the curative intention cannot be obtain'd without mercurials.

5. But the greateſt difficulty of ob=taining this intention is in dropſys; where the great & general ſtretch & diſtenti=on of the lymphaticks & gland throout the whole body often eludes the force of all poſſible diureticks. In this caſe the beſt & moſt effectual method of draving of the waters, is by bliſtering; keeping ſome one or more of them con=tinually running in ſeveral parts of the body till the waters are diſcharg'd, which by this means will be effected in a ſhort time to a wonder: and then a=ny of the common diureticks may take place, unleſs the lymplaticks are broken, ſo as to let out the waters in=to the large cavities of the thorax & abdomen; which is a deſperate caſe.

I know that purging in dropſys even with great violence, is generally indul=

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indulged; & by this means the waters are generally drawn off: but hereby the Stomach, inteſtines, & glandular or=gans of the abdomen are frequently weakend, & overſtretchd, to Such a de=gree, that the waters Soon collect a=gain, in Spite of all that can be done to corroborate & Strengthen the or=gans. And therefore where diuretick will not take place in a dropſy, tis certainly the beſt way to proceed directly to bliſtering; by which a diſcharge may be made without weak=ening & farther Stretching the organs.

Symptoms of relaxed Nerves.

Those who have weak, loose, & feeble or relaxed nerves, have generally a small, weak languid, & sometimes an intermittent pulse. Exercise, strong liquors, high food, or that which is hard to digest, or too great a quantity of these last, taken down, quicken the pulse, & discover a labour & struggle in the circulation. The streaks of such a pulse are seldom free & clean, and sometimes quite stopt & interrupted for some small time: especially in great lowness, fainting or fits; & at best are like a force not applied at once but by straining, & struggling, & slow degrees.

Those that have by nature soft thin & short hair, which with great difficulty receives a buckle, & those who readily run into baldness, or shedding of the hair towards the spring, are certainly of a loose, flabby, & relaxed state of nerves.

As the hairs are in strength bulk & elasticity, so, generally the fibers of the body are: and those whose hair sheds, burns, thin, lank, or refuses the buckle, if it does not happen to them after recovering from an acute distemper, ought to take care they fall not into nervous disorders, which anointing their hair with sweet oils, or washing their heads with honeywater will scarce prevent.

Other things being equal, those of the faireft, clearest & brightest coloured hair, are of the loosest & weakest state of fibers & nerves — we generally observe that people of very fine & white hair, especially if so after they came to maturity, are of weak, tender & delicate constitutions.

Soft & yielding, loose & flabby flesh and muscels, are sure Symptoms of weak & relaxed nerves or fibers, as hard firm prominent & brawny muscles & flesh are constant Signs of firm fibers.

A white fair, blanched, wax or ashen-colour'd complexion, constantly indicates a weaker State of fibers, than a ruddy, brown or dark hue.

A fat, Corpulent & flegmatick constitution is always attended with loose, flabby & relax'd fibers, by their being Soak'd in moisture & oil, especially if it happen long before the meridian of life. —— Those of a dry, firm, and brawny make have generally the Strongest & most tense fibers.

Those who are Subject to evacuations of any kind, in any degree greater than what is natural and common to Sound constitutions; or those who by any accident, a fever or any acute distemper what ever, have Suffered long under any preternatural evacuations, are already or Soon will, become Subject to a relaxed State of nerves.

Those who are naturally of a cold constitution, are apt to fall into chilling & coldness on their extremities, that easily catch cold, are apt to Shiver upon a north east wind, that can hardly bear cold or frosty weather, who need much cloaths or heat: or, who are much Sunk & dispirited, Spent and wasted with excessive hot weather, are all of loose & weak fibers. For all these are Signs of a Slow circulation & perspiration &c. manifest a weak Spring in the fibers of the coats of the vessels.

The fundamental proposition, on which the manner of treating such distempers, is & ought to be grounded, & which experience always justifies, is that a laxity, weakness & want of due tone & elasticity in the Solids, produce viscid, sharp, & ill conditioned juices. And on the contrary, that viscid, sharp, & ill-conditioned juices necessarily produce weak & unelastick Solids.

The first Intention in the cure will be to thin, dilute & sweeten the whole mass of fluids, to destroy their viscidity & glewiness, to open the obstructions thereby generated, make the circulation full & free, the perspiration current, & the secretions flow in their due proportion & tenor. This if fully obtained lays the foundation of all the rest of the cure.

The Second Intention will be to divide, break & dissolve the Saline acrid & hard concretions, generated in the Small vessels, and to destroy all Sharpness & acrimony lodged in the habit, & to make the juices [illegible], sweet, & balsamick.

The third & last Intention, is to restore the tone & elastick force to crisp wind up & contract the fibers of the whole System, which is the last & indeed the most imperfect part of the cure, & the least I am afraid, in the power of art. If this could be always & totally effected, the cure would be a rejuvenescence, & no body needed grow old or die. But the laws of mortal

mortallity will suffer this intention to rise only to a certain height, & no further. — — However there are not wanting means to effect this purpose in some degree, if duely & judiciously chosen, especially if the person is under the meridian of life, while nature has warmth & vigour to assist art.

The time necessary for each intention must be proportioned to the violence of the symptoms & obstinacy of the distemper. — — That which is necessary for the first intention may be conjectured from the state of the blood: if the size on the top is much gone, if the colour & its easily yielding to any dividing instrument, and the proportion of the serum to the globular part upon bleeding (a few ounces only for the trial) be such as they are found commonly in sound persons, and if the serum be clear or not too tawny, then may it be concluded that the first intention has been pursued sufficiently. The second may also be guessed at by from the healing up & cicatrizing of any ulcers, sores, or the cure of any cutaneous foulnesses, and the removal of any acut pains & paroxisms, principally caused by the sharpness & acrimony & saline quality of the juices. The last is obvious, after these two are ascertain'd, by the strength of the vigour, vivacity, & freedom of spirits, & natural & easy performance of all the animal functions, necessarily following upon the last intention's being prosecuted for a due time, & in a proper manner.

The soundest & best blood, is when the globular part is of a moderate

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cohesion & firmness of parts, in a pretty equal proportion to its Serum & of a red & Scarlet colour, when exposed a due time to the air; and the Serum is about the consistence of common water pretty clear, & almost insipid, or, at least, not biting Saltish.

The State I would mention, is, when the globular & grumous part is [redacted] in a far greater proportion than the Serum, more thick & viscid, having a glue or Size on the top (of a blueish at first & afterwards of a whitish or tallow colour, increasing Sometimes to half or more the thickness of the whole) the Serum being in a Smaller quantity & of a yellowish or tawny colr, Sharp, acrid, and Saltish to the taste. This is what is common to pleurisies [redacted] & Rheumatisms &c.

The last State of blood I Shall Speak of, is where the globular part is Scarce any at all, & the Serum above ten times the quantity of it, being Sharp, Saltish & urinous, to the highest degree in its taste. this I take to be the worst State when the Sharpness & acrimony have arrived at their utmost height, like that of those in a confirmed consumption or a dropsy, & some other mortal distempers.

Among the Chief & principal medicines for the first Intention are Mercury and its preparations, Calomel, Mercury alcalisated, precipitate per Se, Quick-Silver, Silver-water Æthiops min. Cinna-

Cinnaber of Antimony, Antimony Diaphoretick, Bezoar Mineral, Crude Antimony, Bezoardicum Joviale, Salt of Tin, Ens Veneris, and the like, whose chief efficacy seems to lie in their weight after they have dropt y^e Salts in the alimentary tube. Next to these are the woods Guajacum, Sassafras, Sarsaparilla, Lignum Nephriticum, the several sorts of Saunders, Wood of Aloes, &c. In the third order are the first Salts, such as Salt of Tartar, Salt of wormwood, Broom, Fern, &c. The last class contains such vegetables as are of an acrid & austere taste, such as are all y^e antiscorbutick plants, of which there is variety.

To prevent athiops from griping & raising tumults in the bowels, I would advise to an astringent warm medicine, such as Diascordium, Mithridate, Venice treacle, & the like to be join'd with it.

That which I generally prefer in viscid juices in persons subject to nervous disorders, in very low cases, is Cinnabar of Antimony, because it creates fewer tumults in the Stomach & bowels & passes more easily into the habit. It ought to be given fresh, or the least stale possible otherwise it may become turbulent in the bowels. and it ought to be as finely levigated as art can make it, to enter more

more readily into the habit & small vessels. its efficacy in childrens Epileptick & convulsive fits, and indeed in all chronical distempers is sufficiently known & acknowledged. I think it the safest & most effectual of all the attenuants in very low cases, especially if a little of the Resin or extract of the jesuits bark be added to it to keep up the force of the Solids, at the same time that it dissolves the viscidity of the juices and is opening the obstructions in the small vessels

The Mercurius alcalisatus (of Quicksilver & Crabs-eyes prepard, & rubbd together till the first disappear) is an admirable medicine, and in a small dose gives no trouble or uneasines, & is specifick in Cutaneous foulnesses, & almost all other Chronical cases, especially nervous, to this first intention. — — — Liquid Quicksilver will do great service in beginning plicatures of the intestines, obstructions of their glands & valves, or in foulnesses, hard concretions or obstructions bred in the mouths of the lacteals ~~& its Steams thereby enter~~ (which are often cases where the Symptoms common to other diseases will not admit a certain distinction) but eminently so in Asthmatick cases, above all other medicines. It forces open the mouths of the obstructed lacteals & its Steams thereby entring the habit, attenuate the viscid juices of the lungs, & render them pervious & so promotes expectoration; and I think other more appropriated & specifick medicines not succeeding, this ought to be tried in all cases of the alimentary tube, since it is as innocent & safe as Asses milk.

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The principal medicines for the Second Intention are, Gum Ammoniacum, Galbanum, Sagapenum, Affa-fœtida, Myrrh, Guajacum, Camphire, Caſtore, Amber, Salt of Hartshorn, Salt of Amber, Saffron, Garlick, Horſe-radiſh, &c. Among theſe I ſhould prefer the Gum Ammoniacum, Galbanum Sagapenum, but eſpecially the Affa-fœtida, ſince we are at the laſt come to judge of, & find out the true, from, & in the adulterated, by its cutting white & turning after-wards of a pinck bloſſom colour according to the deſcription of it by the ancients, by whom its virtues are extreamly celebrated. It certainly deſerves (as a preſent relief in extream caſes) as much as any one medicine. It quiets anxiety & oppreſſion, procures reſt & has all the other benefits of opium, without leaving that lowneſs & oppreſſion behind it which opium when its force is wrought off does on moſt perſons. I ſhould ſay ſome thing of Ammoniacum, but that its virtues are ſufficiently known in aſtmatick & pulmonick caſes, (where it is the ſovereign remedy, & moſt effectuly attenuates viſcid phlegm) to make its efficacy believed in the caſes I am ſpeaking of. Sagapenum likewiſe & Galbanum are effectual for the ſame purpoſe. Garlick & horſe-radiſh ought not to be neglected the firſt of which is as effectual in lung caſes as ammoniacum.

The.

The Medicines which answer this [illegible] third Intention, will be those of the Strengthening & astringent kind, which Contract, Corrugate, wind up & give firmness and force to the weak & relaxed Solids, fibers & nerves. Of this tribe are all the bitters, aromaticks & Chalybeates: Such as the jesuits bark, Steel, Gentian, Tedoary, Galangal, Calamus aromaticus, Snakeweed, Contrayerva, Cinnamon, Winters bark, Chamomile flowers, Wormwood & Centaury tops, terra Japanica, &c. Here likewise the Oak bark, & its offspring the mistletoe, and Acorns, seem to have their proper place, and every thing that is Subacid, whether mineral or vegetable.

Next to the jesuits bark (or even beyond it) is Steel, or Chalybiat medicines and mineral Chalibiate waters, which act principally by constricting, crisping and winding up the relaxed Solids. Weak & young persons, & slight cases, do well with liquid Steel, Such as the vinum Chalybiatum, tinctura Martis, the Solution of Salt martis in common water, Elixir vitrioli, & the like. But those who are Stronger & older require Steel rust, joined with aromaticks, & bitters, & the bark.

Childrens convulsions if they proceed from Shooting the teeth, whereby the gums & their membranes are distended, they are easily cured by incision: but if they arise from Sharp Juices in the Stomach or bowels (as they most commonly do) and the child is about the first year of its age, they may be cured by a blister between the Shoulders; gentle Rhubarb purges frequently repeated

repeated; and the testaceous powders taken two or three times a day in a little black cherry water [redacted] or breast milk but especially by Cinnabar of powders with the testaceous powders and Rhubarb interchangeably. Sometimes a few drops of Spirit of hartshorn taken two or three times a day in common water, if the constitution, juices & Solids, be pretty sound will do the buliness. But if their fits be stronger, & they further advanc'd in life, they must be overcome by gentle vomits fitted to their age & Strength. Cinnabar of antimony, with the pulvis ad guttetam and these & Rhubarb purges, interchangeably used as has been said. But it is to be observed during the whole course that if the child is on the breast, it ought to be fed with nothing but its nurses milk or, if weand with nothing but thin pap, at least till it has gone over its teething. and to give a due force & Strength afterwards, the Quinquina ought to be used either in extract or decoction, especially after it has acquired some years. This method will not only cure their fits, but their Rickets likewise, both proceeding from the same cause to wit, acrid humours lodged in the Stomach or bowels, or some other part of the body, and a relaxation of the Solids.

If such convulsions happen to the younger part of the fair Sex about a certain time of their lives (as they often do) then they generally proceed from some disorder in that great affair which ought if possible to, to be set to right. Which is most effectually to be performed, by frequent vomits fitted to the Strength

of

of the patient & of the disease. While yt is doing, the volatile active gums, with the volatile alcaline Salts are to be combined with cinnabar of antimony in some form or other. This method is to be carried on till the fits are weakened the quantity of the bile lessened and the prima via pretty clear, & then & not till then will proper Emmenagogues, with Steel Chalybeate mineral waters, bitters & aromaticks take place. In the fits themselves there is little to be done but by volatiles & opiates, in appropriated juleps to lessen their violence & to quiet their Spasms; but by a steady continuance in this method, and a proper regimen of diet, I scarce ever saw the patient miscarry.

As to the fits of grown persons Hysterical or Hypochondriacal their violence is to be lessened, at least in the first instance, by all the great evacuations, Especially bleeding, vomiting, blisters, Glysters, & the like; & there the Spasms & convulsions are to be quieted with opiates, with nitrum & volatile medicines & fixed gums, according to the Strength of the patient & the necessity of the disease. If these evacuations cannot be conveniently made, or do not soon enough take effect, there is nothing else to be done under the fits, but by these mentioned opiates, volatile gums & Salts, aromatic & alcaline Spirits in proper juleps, till a convenient interval be obtained or ye violence of the convulsions ceases, & then rouzing vomits are to be thrown down and after that sharp glysters (with Emetick wine & volatile Spirits in them which will check their further return for some time.) This method is to be repeated as often as these paroxisms return. During the intervals Cinnabarine medicines, or Ethiops, the Merc. dul. or Alcalisatus, with the volatile gums & Salts are to be taken once or twice a day, with Chalybeate waters & aromatick bitters, & at night the gum pills, compounded with the vola

volatile Salts the general method already laid down, being at the same time regularly pursued. — — — —

— — — In my judgment the greatest Stress is to be laid (especially in gross habits or Symptoms produced even by relative intemperance only) in the medicinal way, upon vomits often repeated, Quinquina bitters, aloetick purges, & mineral or chalybeate waters which not succeeding little is to be expected from art, & therefore they must be left to palliative remedies of warm opiates, such as venice treacle, with high & strong cordial juleps & volatiles.

As to the fits attending other nervous disorders, as the Apoplexy, Epilepsy & the like, that part of them which is convulsive depending entirely on the primary distemper, being the Struggle of Nature to throw off the peccant cause if it were possible to Separate them, they were to be treated in the same manner and by the same medicines: but intending to say Something of them in particular, I shall here pass them by, and only add, that the several forms, Doses & other circumstances in using these medicines I have already mentioned in the proper cases, requires the attention of the wisest & most experienced physician, to whom these means & medicines may be familiar & are never to be trusted to any one not duely & regularly instructed & educated in these matters.

In Nervous asthma's with phlegm, or perhaps in humourous asthma's, both of persons of firm & lax solids, liquid Quick Silver, (or Bellosts pills made with gum ammoniack) will be found a Sovereign remedy, if discreetly managed half an ounce taken once or twice a day, with a thin light fluid diet, will do more than ammoniacum alone, and all the class of the volatile & foetid medicines to dissolve flegm, assist expectoration and to make expiration & inspiration easy..

General Rules for health & long life drawn from the head.

of Air.

1. The healthiest Situation for a Seat is in a champaign country, or on the Side of a Small eminence, on a gravelly Soil with a Southern or western exposition Shelter'd from the north & east winds, distant from any great concourse of waters, or any great mines or beds of minerals, where the water is Sweet, clear, light, Soft, and tastless.

2. Tender people on the Setting in of easterly & northerly winds ought to change their bed-rooms for others of westerly & Southerly lights, & the contrary in wet Seasons.

3. Those who have been much exposed to, or long abroad in easterly or northerly winds Should drink Some thin & warm liquor going to bed.

4. When the dark dull foggy weather lasts at London in winter tender people & those of weak nerves & lungs, ought either to go into the Country, or keep much at home in warm rooms, go early to bed, and rise betimes.

5. Valetudinary people ought to have their Servants, children, & bed-fellows, or those they continually approach, and converse with, Sound, Sweet, & healthy or ought to remove them till they are So, if they are otherwise.

6. Eve-

6. Every one in order to preserve their health, ought to observe all the cleanness & Sweetness in their houses, cloaths and furniture, Suitable to their condition.

General Rules for health & long life, drawn from the head of Meat & Drink.

I. The great rule of eating & drinking for health is to adjust the quality & quantity of our food to our digestive powers: the Quality may be judged of, by the following rules.

2. Those Substances that consist of the grossest parts are hardest of digestion; the constituent particles coming into more contracts & consequently adhering more firmly.

3. These Substances whose parts are brought together with the greatest force, cohere proportionably closer than those that come together with a Smaller momentum or force.

4. Salts are very hard to be Separated because united by plain Surfaces, under which they are always comprehended. and in the last Stages of the circulation where it is Slower, Shoot readily into larger clusters, and So are harder to be driven out of the habit. from these we may easily infer that (1.) those vegetables & animals that come

Soon

soonest to their full growth are easier of digestion than those that are longer attaining the State of maturity. (2.) those that are the smallest of their kind than the biggest. (3.) Those of a dry fleshy & fibrous substance, than the oily fat & glutinous. (4.) Those of a white substance than those of a more flaming colour. (5.) Those of a mild soft & sweet, than those of a strong, poignant, aromatic or hot taste. (6.) Land animals than Sea animals. (7.) Those animals yt live on vegetables, or other light food than those that live on other animals or hard & heavy food. (8.) The nourishment nature has appointed for young animals is lighter than the flesh of these animals themselves.

5. All cramm'd poultry & Stall-fed cattle, and even vegetables forced by hot beds, tend more to putrefaction & consequently are more unfit for humane food than those brought up in the natural manner.

6. Plain-dressed food is easier of digestion than what is pickled, salted, baked, smoked, or any way high-seasoned.

7. Strong men, those of large Stature, and much labour, and the inhabitants of a cold & clear air, require more food than women, women, children, the weak & Sedentary, & the aged, & those that live in a warmer climate or grosser air.

8. Nothing conduces more to health and long life than abstinence, & plain food, with due labour.

9. Where exercise is wanting (as in Studious persons) there is great need of abstinence: for these 8 ounces of animal, and 12 of vegetable food, in 24 hours, is sufficient.

10. Most Chronical diseases proceed from repletion; as appears from their being cured by evacuation.

11. Tender persons ought to use as much abstinence, as they possibly can: and if they neglect it their only relief is from frequent Stomachick & family purges.

12. A plain rule for judging of the quantity is, not to eat so much as indisposes for Business.

13. A more sensible & readier one is first by experience to find out how much fits one, so as to be lightsome & healthy under it, and ever after to judge the quantity by the eye; Nature requiring therein no mathematical exactness.

14. Pork & fish are not fit food for the Studious & the tender.

15. Water is the most natural & wholesome of all drinks, quickens the appetite & strengthens the digestion most.

16. Strong & Spirituous liquors freely indulged, become a certain tho' a slow poison.

17. There is no danger in leaving them off all at once: the plea for continuing them being false & groundless.

18. The best Strong liquor for weak and Studious people is wine; the best quantity a pint in 24 hours; and the best way of

of drinking it is three glasses with, and three without water.

19. The middling light wines fully ripe and of a due age, are preferable to the strong wines.

20. Strong liquors do not prevent the mischiefs of a surfeit nor carry it off so safely as water, tho they seem to give present relief.

21. The frequent use of Spirits in drams and cordials is so far from curing low Spiritedness that it increases it, and brings on more fatal disorders.

22. And even when they are diluted with water in punch, the quantity taken down at once, & the addition of a corroding acid, produce equally pernicious effects in human constitutions.

23. Malt liquors (excepting clear small beer of a due age) are extreamly hurtfull to tender & studious persons.

24. Coffee is only an infusion of a kind of Calx & has the effects of an absorbent medicine; & so may be of some service to watry stomachs, if moderately used.

25. Green tea is a good diluter of y^e food, as it is an agreable warm small liquor: but Bohea is too heavy for y^e stomach.

26. Chocolate (as all nuts else) is so heavy & hard of digestion, that it can never be fit for the stomachs of weak & tender people.

27.

27. Smoaking tobacco, ~~without~~ drinking after it, Chewing & ~~cut~~ Snuffing the grofs cut leaf in a morning, are ufeful to flegmatick conftitutions; but to dry & lean habits they are pernicious. Snuff is juft good for nothing at all.

28. The proper quantity of watry liquors in 24. hours, to thofe who live regularly is two pints, (as that of Strong Liquor is one pint) Which is beft drank warm, and rather after than in the time of eating.

29. The form of a cordial fit to be kept in private families, as a prefent & certain relief for Sudden Qualms, Faintnefs, Sicknefs & low Spirits. but never to be taken but in cafe of neceffity.

Rules for health and long life, drawn from the head of Sleep and watching.

1. The valetudinary, the Sedentary & the ftudious Should eat very light, or no Suppers, if any it ought to be vegetable food: neither ought they to go Soon to bed, after any Supper whatever.

2. Going to bed on a full Stomach, and wind and crudities Somewhere in the alimentary paffages, is the cauſe of the want of due reſt

reft, which is found & refreshing, always in proportion to the emptiness & clearness of of these passages, and their vacation from their proper office of digestion: and this is the cause of the want of kindly & refreshing reft, in hypochondriacal and hysterical people.

3. Watching by night & Sleeping by day, is of the most pernicious consequence to health & long life: and plainly contrary to the indications of ~~the~~ nature and the constitutions of our bodies.

4. The valetudinary Sedentary & Studious, ought carefully to avoid evening news, nocturnal Studies, & unseasonable watching. go to bed by eight, nine or ten, and rise proportionably by four, five, or Six; unless actually under a fit of Sickness.

5. Nothing is more prejudicial to tender constitutions, than lying long a-bed, indulging a lethargical & drowsy Sleep, or lolling or loitering awake; as appears by their heaviness, and want of appetite, upon doing so; and their good Stomachs, cheerfulness, & freedom of Spirits, when they rise early.

6. The most advantagious manner for the tender, Sedentary & Studious, to dispose their time, on account both of their health & Studies, is to go early to bed rise betimes, go about their Studies till eleven, taking a light vegetable breakfast: prosecute them till about four in the afternoon then to take their great meal of animal food, and after that to employ the reft of

of their time in some innocent amuse=ment, or gentle bodily exercise; to re=tire betimes, to prepare for going to bed, taking no farther nourishment except a draught of water or warm Sack-whey, which will be particularly useful to those who labour under Stone & gravel.

Rules for health and long Life, drawn from the head of Exercise and quiet.

1 Whatever was the original consti=tution of man, in our present State a due degree of exercise is indispensa=bly necessary towards health & long life.

2. Animal food & Strong liquors, seem not to have been design'd for man in his original make & frame; but rather indulg'd, to Shorten the anticdiluvian length of life, in order to prevent the excessive growth in wickedness.

3. Walking is the most natural & effec=tual exercise, did it not Spend the Spirits of the tender too much. Riding on horseback is less laborious, and more effectual for Such. Riding in a coach is only for the infirm, & young children. House exercises are never to be allowed but

but when the weather or Some bodily infirmity will not permit going abroad; for air contributes mightily to the benefit of exercise. Children naturally love all kinds of exercise, which wonderfully promotes their health, increases their Strength, & Stretches out their organs.

4. The organs of the body that are most used always become Strongest, and therfore we may Strengthen any weak organ by exercise.

5. The lungs are best fortified by loud talking, and walking up an easy ascent. The digestion & nerves are Strengthend & most headaches cured by riding: the Stone & gravel eased by riding in a coach over rough ground; Rheumatick pains by playing at Tennis Billiards, &c. till one Sweat, & then going into a warm bed to promote the Sweating: feeble arms by playing at Shittlecock or Tennis; Weak hams by foot-ball, and weak backs by Singing or pumping. The gouty best recover the use of their limbs by walking in rough roads; but prevent the fits best by riding on horse-back or in a coach. The valetudinary and the Studious ought to have Stated times for exercise at least two or three hours a day the

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one half before dinner, & the other before going to bed.

6. Excercife, 1. Should always be gone about with an empty Stomach: 2. Shoud never be continued to wearyneſs: 3. after it, one muſt take care not to catch cold. And it Should always be accompanied with temperance, elſe inſtead of a remedy, it will become an evil.

7. Cold-bathing is of great advan=tage to health; but Should not be uſed under a fit of a chronical diſtemper with a quick pulſe, or with a head-ach, or by thoſe who have weak lungs. It promotes perſpiration, inlarges the circulation, and prevents the danger of catching cold. Thoſe of tender nerves Should pour water on their heads before they go in, & none ought to jump in ſuddenly, & with their heads foremoſt.

8. The fleſh-bruſh is a moſt uſefull exercife, as appears by its advantage to horſes, & ought not only to be u=ſed on human bodies, but alſo on Such of the animals we deſign for our food, as it can be applied to.

Rules for health & long Life drawn from the head of Evacuation.

1. COSTIVE Stools are Signs of overheated blood too Spare feeding Slowness of digestion, or weakness of the guts.

2. Purging Stools Show intemperate feeding. Too full a meal has the effects of a purge, fills the guts with wind and gives the gripes: Mercury, & even the Bark, Diascordium & Treacle if over-dosed, purge.

3. Head-aches, Sick Stomachs, vapours, low Spirits, gripes & collicks, proceed from evamoning, and are ever accompanied with loose Stools.

4. Those that live temperately have one regular Stool a day. Those who have more, exceed.

5. The cure of all relaxations of the nerves (the Source of all chronical diseases) must necessarily begin at the Stomach, and guts.

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6. The time from eating a meal till its discharge, is three days, in those that have one regular Stool a day, Six in those that have but one in two days.

7. A gross meal produces more disorders the day the excrements of it go off, than the day it is eaten.

8. A meal takes the Same time to get thro' the habit by perspiration that its remains do to pass thro' the guts.

9. The errors of the first concoctions cannot be mended afterwards.

10. Pain or relief, is not always the effect of the last meal or medicine that was taken down.

11. Though Cheese, Eggs, milk and vegetable foods, may be hard to digest, without drinking water to Some Stomachs; yet their Chyle is good, and produces no bad effects.

12. Turbid water with brick-dust Sediment, proceeds from the critical discharge of what was preternaturally retained in the habit.

13. Pale Sweet water from the urinous Salts being yet retained.

14. There is great difference between Hysterick pale water and that which proceeds from a diabetes.

15. That appearance of fat on the urine of Some people, is nothing but a thin film of Salts

16. Bright Amber-coloured water with a light Sediment riſing toward the top, a-mounting to three quarters of what is drank, is a good Sign of good digeſtion.

17. Great quantitys of pale water proceed from exceſs in the quantity of food, and want of exercise. The cure of it is perfor-med by eating leſs, uſing more exercise and taking Some diaphoreticks, to Set the perſpiration right.

18. High-coloured turbid water in Small quantity Shews abundance of animal Salts in the habit, or the immoderate uſe of Spirituous liquors: and muſt be cured by water, or other Small drink, & vegetable food.

19. Dark brown water, or of a dirty red is extreamly dangerous, both in acute cases, and in thoſe who Seem at preſent to ail nothing.

20. Bloody purulent water, & full of films, is a Sign of nephritick ailments, Stone & gravel.

21. The viſcid matter like gelly in the Stools, & the viſcid milky Subſtance Somewhat like matter in the urine of Some people of weak nerves, proceed from a corruption of the liquor of the mucous glands of the inteſtines, and of the bladder, & other urinary paſſages.

22. Obſtruction of perſpiration is one Source of acute diſeaſes, and a conſequen-ce of chronical ones.

23. Catching of cold is an obstruction of perspiration by the humid & nitrous particles of the air. It Should be cured by gentle diaphoreticks, and not by balsamick pectorals, which do no good but in the end of the cure, to promote expectoration from the lungs, if there be any occasion for it.

24. Persons of weak nerves, have often a critical flux of Rheum from the glands of the mouth & throat, to a very large quantity, which if not tampered with, brings them great relief.

Rules for health and long Life drawn from the head, of the Passions.

1 The Passions have a greater influence on health, than most people are aware of.

2. All violent & sudden passions, dispose to, or actually throw people into acute diseases. and Sometimes the most violent of them bring on Sudden death.

3. The Slow & lasting passions, bring on Chronical diseases. as we See in grief, and languishing hopeless love.

4. Therefore the Sudden & acute passi=ons are more dangerous than the Slow & Chronical ones.

5. Men of lively imaginations and great vivacity, are more liable to the Sud=den and violent passions & their effects.

6. Thoughtfull people & those of good un=derstanding, Suffer most by the Slow, and Secretly consuming passions.

7. The indolent & the thotless Suffer least from the passions: the Stupid and ideots not at all.

8. The diseases brought on by the passi=ons, may be cured by medicine, as well as those proceeding from other causes, when once the passions themselves cease, or are quieted. But the preventing or calming the passions themselves, is the business not of physick, but of virtue and religi=on.

9. The love of god, as it is the ~~Sovereign~~ Sovereign remedy of all miseries, So, in par=ticular it effectually prevents all the bodily disorders the passions introduce, by keep=ing the passions themselves within due bounds: and by the unspeakable joy and perfect calm, Serenity & tranquillity it gives the mind, becomes the most power=full of all the means of health & long life.

Miscelany

Miscelany Rules of health & long Life.

1 Chronical diseases last long, wear out constitution leisurely, and are accompanied with a slow pulse; whereas acute ones soon terminate either in death or recovery and are ~~cured~~ joined with a quick pulse.

2. The Scurvy is the root of most chronic diseases of the british nation; and is a necessary consequence of their way of living almost wholly on animal food, and drinking so much Strong liquors.

3. Soft, thin Small, Short, fair hair, Slender muscles & bones; Soft flesh; A white fair, blanched or ashen-colour'd complexion; a fair, corpulent, flegmatick, cold constitution: chilliness, especially in the feet; a readiness to catch colds; And being subject to immoderate evacuations of any kind, are certain Signs of loose, flabby, or relaxed nerves.

4. Women of weak nerves are very subject to Miscarriages. Their danger is increased by high living & indiscreet bleeding. The only remedy for them is drinking Bristol water & red wine with a low & light diet, going abroad to get air, and using astringent plaisters and

and other proper medicines to corroborate the bowels.

5. The weak & Sickly (as their concoctive powers fail in winter and recover in Summer) Should carefully proportion the quantity & quality of their food to the Strength of them in the Several Seasons.

6. The fewer cloaths one uses, the hardier he will be. Flannel and great loads of Cloaths by day or night relax the fibers & promote only Sweating instead of the natural & beneficial perspiration.

7. The weak Sedentary & Studious Should frequently Shave their heads & faces, wash & Scrape their feet, & pare the nails of their toes.

8. People that read & write much ought to do them Standing, or in as erect a posture as they can. And those who can go about any part of their Studies walking, Should do it.

9. The fat unwieldy & overgrown ought to avoid all manner of drink Strong & Small, and even water itself as much as possible. And if their food be vegetables, or young animals, they will have little occasion for any liquor.

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10. The Aged Should (1) guard against all the injuries of the weather: and (2.) leffen the quantity & lower the quality of their food gradually as they grow older even before a manifeft decay of appetite force them to it.

11. As Chronical diseases are not brought on all at once; So they cannot be quickly removed. A gradual corruption muft be gradually remedied. Tis contrary to the nature of chronical diseases to be quickly cured.

12. In all acute & vehement pain, Opium is the Sovereign relief, particularly in the cholick, Stone, gout, Rheumatism & hard labour of women. It operates by relaxing & unbending the fibers, overStretched & crifped up by pain.

13. The great Secret of health and long life, lies in keeping the blood (and consequently the other juices of the body) in a due degree of fluidity.

hence it comes to pass that a vegetable diet for a few weeks or months, together with drinking water or unfermented liquors (such as tea, coffee barley-water, Liquorise-water, Teas made of oranges, or other Seeds and plants) will fasten the teeth when droping out, from a consumption of the gums by Scorbutic Salts, cure any cutaneous foulnesses, or eruptions, and even any Spreading ulcer, if it is not Scrophulous, when no medicine on the face of the earth can touch it. Hence the grand maxim in the cure of all ulcers is, by diet to bring them to the State of a wound, & then they will cure of themselves.

— — — 1. Nothing is So powerful or So powerfull a diaphoretick as an opiate. Nothing causes such plentifull Sweating, especially, especially if joined with volatiles, and promoted with plentifull drinking small, warm liquors. This it can do only by relaxing the fibers of the Skin & perspiratory glands. 2. Nothing So much palls the appetite, & weakens the first digestions, as the frequent use of opiates;

insomuch

insomuch that most people, after a liberal dose of them, seldom fail to reach and never care for food till a considerable time after, till their effects are wrought off; which are the constant Symptoms of a relaxed Stomach & guts. 3. Nothing so much promotes the eruption of the Small pox & measles, the expulsion of the Stone & fœtus, the monthly & the after-birth purifications of the Sex, as opiates: insomuch, [redacted] that in difficult births they are now the only resource of the midwife physitians; and, when joined with volatiles, will bring on the most powerfull & vigorous throes, in the most weak & languishing constitutions. These effects they can produce only by relaxing those fibers pain has contracted & rendered unelastick in some measure. 4. Nothing quiets and stops Cramps, Convulsions & hysterick so suddenly and certainly as opiates do. And every one knows these arise from violent contractions & crispings up of the muscular fibers. — — — — — — It stops purging & cures a diarrhea. — — — I will not take upon me here to determine the proper cases for opiates or their [redacted] doses. — — — But in genrival I may say, wherever pain is acute, intollerable & past enduring, where it may endanger convulsions, a fever or inflamation; after premising the proper universal evacuations such as bleeding, blistering, cuping, purging or

or glistering, as the case requires, or will bear) opiates then will most certainly relieve, and may be safely administer'd. If the case is attended with vomiting, Solid opium will do best. because it will be in a Smaller volume and will not be so readily rejected. If Speedy relief be required where there is no vomiting then Laudanum will disperse Soonest thro' the habit, because liquid & joined with a Spirituous vehicle will Soonest effect the design, raise the oppressed Spirits more, & penetrate deeper & quicker. In common cases a vinous vehicle will be Sufficient, becaus opium is best dissolved in wine to make laudanum. There are four cases in which tis absolutely & eminently necessary: the Cholick: the Stone: the hard labours, & After-birth & monthly Sluggish purifications of the fair Sex, especially if attended with violent pain, as is common in Such cases: and in the gout & Rheumatism. In the first it ought always to be given with Some Stomach purge, as Elixir Salutis, or Tincture of Hiera Picra, with Syrup of Buckthorn, and in those of more tender bowels, with tincture of Rhubarb especially if the Cholick is in the lower bowels & attended with no vomitting. in which case an artificial vomit is to be premised if circumstances forbid it not

it not. In the Stone it ought to be given with oyl of Sweet Almonds, or in some soft emulsion, to lubricate the parts. In the two last cases it ought always to be given with proper volatiles, antihysterics & attenuants. In violent & acute pain, the first dose ought to be large, at least from thirty to forty-five drops of liquid Laudanum, or its equivalent in Opium from two grains & an half to three and an half; and afterwards to be increased by fifteen drops of liquid, or half a grain of solid Laudanum every half hour, till the pain begin to remit; and then an entire Stop is to be put to its administration. And thus the end will be obtained without any fear of over-dosing. — — — — — — — — If the preceeding dose be rejected by vomiting, about a third part may be supposed to stay; and then the subsequent doses may be proportioned accordingly. The difference of constitutions will make no great alteration here, since very weak persons seldom suffer very violent pain, which is the only case I am here considering.

The Substance of Dr. Quincys discourse on purging, inserted in the Philosophical transactions.

1°. That all those parts of an animal body wc. are vascular or thro wc. any fluid passes, as from the intestines to the minutest fiber, are the Seat of the operation of medicines.

2°. That this whole course of circulation or animal motion, is naturally distinguished into three different Stages, by the different capacitys of the vessels, and motions of their contents, each having its proper out-let; and that these are the Seat of the three concoctions, so often mentioned by physical writers: the first being the Stomach & bowels, and having the Anus for its emunctory; the Second all that Space within the blood's motion, so far as it retains its red colour, having the kidneys; and the third all beyond that circuit, having the Skin for an excretory organ.

3°. That every medicine which cäseth evacuation is in some Sense a purge.

4°. That every purge operates as a dissolvent by fusing the juices, and increasing the quantity fit for expulsion; or as a Stimulus, by increasing (accelerating) their motions, So as to bring the matter fit for expulsion, oftener to the Secretory outlet; or both.

These Postulata are only premised in order to prove this grand proposition, that a change in the bulks, figures, and motions of the component particles of a purging medicine, will change the Seat of its operation, and fit it for excretion in the larger or smaller vessels, as those mechanical affections are intended or remitted.

For

For illustration hereof, it may be convenient to the common way of making a purge operate, more or less than it otherwise would do.

Substances then, which are gross & heavy, as those consisting chiefly of Saline and earthy particles: Such as Tartar, Manna, and the like, when reduced smaller by triture, or repeated Solutions, operate more gently: but when acuated by acids, or any way made to expose their angles more plentifully to the membranes, they become rougher, & sooner take effect.

Resinous medicines, as Scammony, Gamboge, Jalap, & most of vegetable production, are more violent & operate sooner, when they are more tenacious, and adhesive, as in their extracts: but gentler when divided by hard, brittle Substances, such as Salt of Tartar, Sugar, &c.

Medicines which have in their composition, Sulpher & Salt, are more or less rough, and speedy in their operation, in proportion to their greater or lesser participation of the Saline ingredient, and the asperity of its angles.

—— Of this kind are most minerals, and their preparations: It may be sufficient to instance in the management of Antimony & Mercury: the first of these is by Chymical Analysis known to be a composition of a subtle Sulpher & Salt. and the more the Saline part is set loose by preparation, and opening the Sulpher, as it is commonly termd, the speedier, & with the greater vehemence will it operate; whereas in its more imperfect preparations, when the Salts are closely wrapt up in their native Sulpher it will hardly work at all till it reaches the farthest Stages of circulation.

Mercury

Mercury per se, is little known as a medicine, and its first preparation which makes it into Sublimate, so loads it with Saline Spicula, that it amounts even to a poison: but the more those Spicula are broken, by Triture, Sublimation, &c. the milder doth it operate; and if to the comminution of its points, be added a Sulpher Subtile enough to join it, it may be reduced to so mild a medicine, as not to be felt, but in the last Stage of operation.

This Short view may be Sufficient to Shew,

1°. That it is the too great asperity, and motion in a medicine, that will not Suffer it to pass the Stomach, without irritating it into Such convulsions, as will throw it up again by vomit.

2°. That a farther comminution, and Smoothing its figure, will gain it admittance into the bowels, and cause it to operate by Stool, as a proper purgative.

3°. That a yet farther remission of these properties will convey it into the blood, and allow it there to promote evacuation by urine,

and lastly that a Still farther comminution will pass it into the minutest canals, where, by the Same properties only in a lower degree, it will cause Sweat, or increase perspiration.

Hence it appears that the more Subtile medicines operate in the capillaries and Smallest fibers by the Same mechanism, that the more grass ones do in the common Stream of the blood, when they go off by urine: or as the grossest of all do in the greater passages, when they promote evacuation by Stool.

Hence it is evident that the Skill of preparing and administring medicines in proportioning their manifest, and known properties, to the capacity, and circumstances of the part they are to operate in; and to intend, or remit their mechanical affections, as they are Sooner or later to take place in the greater or Smaller vessels.

Of the

Of the first class there are few to be reduced small enough to go beyond the larger passages, and none of them are worth the pains they require, to fit them farther than for diuretics: Besides their natural disposition to attract, and join with the serous part of the blood, whenever they get into that stage of motion, runs them off by the kidneys, before they can undergo commixtion enough to get farther: but if by frequent repetitions of such medicines, and an uncommon laxity of the passages, any thing is passed into the habit, their grossness fouls the delicate strainers, which are destined for their expulsion; and they lodge upon the glands and capillaries in such a manner, as to induce intermittents, which is observable in many persons, after a long use of cream of tartar, the common cathartic salts, and the purging waters, especially at the latter end of the summer, when the heat of the preceeding season has debilitated the solids, and left them under too great a relaxation.

Among the resinous purges there are many very powerful ones, but where their operation is desired in the viscera, blood and remoter parts, they must be extreamly divided: and this we find spirituous menstruums will do, by taking up the most subtle parts only, & carrying them into the very small passages, where the operate chiefly by fusion; because the softness of such substances cannot enable them, barely in any degree, to act as stimuli, farther at least than as ordinary detergents. and thus we find that Aloes the chief of this tribe goes goes farthest into the habit, and continues longest ere it operates, when managed with a spirituous menstruum, as in the Tinctura Sacra. The Radix Turpethi and Colocinth likewise, with all the vegetable kind, that will yield to a spirituous liquor, are, by that means, to be carried into the farthest scenes of animal action; where they will prove

prove efficacious medicines in cases, [illegible] which, with other management, they would never be able to reach: and on this account it muſt undoubtedly have been, that we frequently meet, in practical writers, with many materials of this Sort mentioned as alterants; the Colocinth particularly by Helmont: for all medicines which operated in the farthest paſſages, they generally commonly include under that appellation.

But the moſt efficatious purges, and thoſe which require the maſt Skill are procured from the mineral kingdom: theſe abound in Solidity beyond any other materials, and therefore wherever they are brought into action, neceſſarily excel in quantity of impulſe: Many of theſe therefore want not only the utmoſt comminution to carry them into the farthest Scenes of operation, but alſo Some reſtraint of their aſperitys, and motions, to fit them for many intentions. ——

Thus Sublimate is not only to be much Sweetened that is, Smoothed in its points, to make it a Safe purge in the larger veſſels; but if it be intended to go farther than the blood and thoſe glands which, in that circuit it is moſt apt to be lodged upon, when it Salivates, it muſt not only be reduced very fine, but alſo be covered with Such Subſtances as weaken the points, and make it Strain into the laſt Subdivisions of the conſtitution. To this purpoſe the common practice wiſely contrives, in diſtempers which according to the courſe of circulation lie moſt remote to wrap up the baſis of this medicine, in Sulphers, and Such like Subſtances, as follow it into its laſt diviſion, without giving it any aſperities, to make it act as a Stimulus. Thus for all cutaneous foulneſes, and habitual taints the Cinnabar, the Æthiops, and all of that Sort ment are in readineſs: and that ordinary Sulphers will cover and deaden the efficacies of mercurial preparations, So that they Shall not operate, but

parts only, and in certain circumstances, is demonstrable in ordinary Salivations, which are to be lowered by Sulphureous medicines. Medicines from such minerals, where a Salt and Sulpher are united by nature, as they are in some mercurials by art, as in Antimony, the native Cinnabar, Steel &c. are manageable only upon the same principles. and the more they are designed to be carried into the habit, the more are they to be restrain'd by their natural, or adventitious Sulphurs: Steel when opened by, and joined with the points of acid liquors, operates the sooner, and will sometimes prove even Emetic; but when it is cover'd with an additional Sulpher, it will go farther & answer intentions much more remote; as is manifest in the common preparations of Steel, with Tartar, or vinegar, & and with Sulpher.

This way of reasoning on these occasions seems the more just, from considering the texture of those Substances which by a natural preparation are fitted for operation in the minutest part of an animal body; such as those of the aromatick kind, all which more or less, according to their greater or lesser degree of Subtlety & Smoothness, promote a diaphoresis: for these consist of exquisitely fine Salts, cover'd with a most Subtle Sulphur, as is demonstrable by Chymical analysis: and the common Sal Volatile Oleosum is an admirable contrivance upon the same foundation, where where a very volatile animal Salt, is cover'd with a most exalted vegetable oil, whereby it is fitted into the minutest fibers, and make as it were, a part, of the animal Spirits themselves and here it may not be amiss to observe, that all animal Salts are very volatile, or easily render'd so; but when bare & naked, just as the fire drives them out, with a mixture also of its own particles, in their composition,

they

they are too pungent to be felt without painfull Sensations: and when Soften'd with a fine portion of Somewhat of an opposite texture, which is Smooth and yielding they become most efficatious, & Safe Sudorifics.

On these considerations, it likewise ceases to be a wonder why the Subtle Salts of Cantharides are more Sensibly injurious to the bladder, than any other parts, & why Camphire prevents those injurys: for the exquisite Smallness of those Spicula make ym imperceptable, but in the most minute canals into which the fibers composing the Membranes of the bladder are known to be divided: and Camphire blunts their irritations, because its exquisite Subtlety enables it to follow them into those meanders, and Sheath their asperities.

To this purpose is very remarkabe what many now commonly practice in guarding even Mercurials against their Stimulating properties, and Sending them into the first passages to operate by fusion, and the bare force of impulse: For not only Calomel & the Mercurius Dulcis may be restrained from manifest operation in the wider passages & the glands about the mouth. but even the Mineral Turbith, which of it Self in a Small dose, will operate powerfully by vomit and Stool, will not when mix'd with Camphire, be so much felt in those respects, but go into the farthest circuit of motion, and promote the cutaneous discharge in a more efficatious manner, than any medicine of less Specifick gravity. —

In

In this management the Camphire is to be mixd but a little before taking

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The best Jalap is that which breaks blackest, most brittle, Sound & Shining within Side.

Vinegar will not dissolve mercury; and hence we are furnishd with a method of detecting the frauds of Druggists. So but take a mortar & pound the merc. with vinegar therein, if the vinegar grow Sweetish, it is a proof there is a mixture of lead: if copper have been mixd with it, the mercury will turn greenish or blueish; if there be no adulteration, the mercury & vinegar will both remain as before.

Rhaponticum, frequently mixed with Rhubarb, is distinguishd from it by this, that the Rhubarb is usually in roundish pieces, the internal Streaks or lines whereof run transverse the Rhaponticum in longish pieces, having its Streaks running length-wise. Besides, that Rhaponticum chews in the mouth, leaves a viscidity behind it, which Rhubarb does not.

Rhaponticum verum, is distinguishd from Monks-Rhubarb (So frequently Substituted for it) by this, that the

the former is yellow without and reddish within, but the latter blackish without and yellow within.

The Rhaponticum of the Shops is no other than Monk's Rubarb or mountain Rhaponticum which is much inferiour to the true. The Dr. Quincy confounds the two.

Scammony, is the inspissated juice of the root of a plant of the same name, growing in the Levant, particularly about Aleppo.

The good genuine Scammony of Aleppo, is to be grey, tender friable & resinous; the taste bitter, and the smell faintish & disagreable.

The Turbeth Sold by our druggists is longish, about the thickness of the finger, resinous, heavy, and of a brownish hue without, and whitish within. tis brought to us cloven in the midle, lengthwise, and the heart or woody matter taken out.

Extract of the Juice of English white Poppy heads, is about half as Strong as Turkish opium.

Bishop Berkley Says (in his Siris) Tar in Substance, mixt with honey, I have found an Excellent medicine for coughs.

Sect. 79. I have known a bloody flux of long continuance, after divers medicines had been tried in vain, cured by tar-water. But that which I take to be the most Speedy & effectual remedy in a bloody flux, is a Glyster of an ounce of common brown rosin dissolved over a fire in two ounces of oil, & added to a pint of broth; which not long Since I had frequent occasion of trying when that distemper was epidemical: Nor can I say that any to whom I advised it miscarried.

The manner of preparing Opium in Ispahan, (where the greatest quantitys are made) is, taking the Poppy Green, and cleaving the head in two, when issues a white Liquor, which in the air is coagulated to a black Substance.

The great quantitys of Salt peter vented at Surratte, are made at Aymer out of the fattest ground, after it has lain fallow for a considerable time; they dig certain trenches &c. after they have filld with Salt earth, they let in as much water as is sufficient to reduce it to the consistence of a broath, when by treading it with their feet, they judge the water has dissolvd all the Saline Substance yt was in the earth, they draw up the water into another trench, where in some time it thickens, when they boil it like Salt, Scumming it continually, and afterward put it into earthen pots; where the dregs being Settled to the bottom, they take it out again and dry it to a hard Substance in the Sun.

For the Tooth-ach, a paſt made of ſoft bread and the ſeed of Stramonia, laid on the tooth affecting abates the pain. If the tooth be hollow and the pain great, a compoſition of equal quantities of Opium, Myrrh and Camphire, made up into a paſte with brandy, and about a grain or two put into the hollow place, puts a Stop to the caries, and blunts the acute pain of the Nerve; by which it often gives immediate relief.

Monſieur Belloſte gives us a medicine of ſingular efficacy in the cure of ulcers; and it is no more than a decoction of Walnut leaves in water, with a little Sugar; in which a linnen cloth being dipp'd, is to be laid on the ulcer, and this to be repeated every ſecond or third day. This Simple & vulgar medicine he finds ſuppurates, deterges, incarnates, reſiſts putrefaction, &c. more than any other medicine known.

The famous Sugar, or Remedy given by Fordeus, for the worms in children, is fifteen grains of Merc. Dulc. with five grains of Scammony, or two or three times as much Sugar, made up in Lozenges.

In a healthy person the matter that is insensibly perspired thro' the Skin is $\frac{5}{8}$ of that taken in.

in a nights time, about 16 ounces is ordinarily sent out by urine; 4 ounces by Stool; and above 40 ounces by insensible perspiration.

For some time after eating perspiration is least of all. Between the 5th and 12th hour after meals perspiration is greatest. That riding either on horse-back in coach or Ship, &c. brisk motion on the ice &c. but above all a brisk frickion of the Skin; promote perspiration surprisingly. That in Sweating the perspiration is much less than at other times. Perspiration is always much less in women than in men.

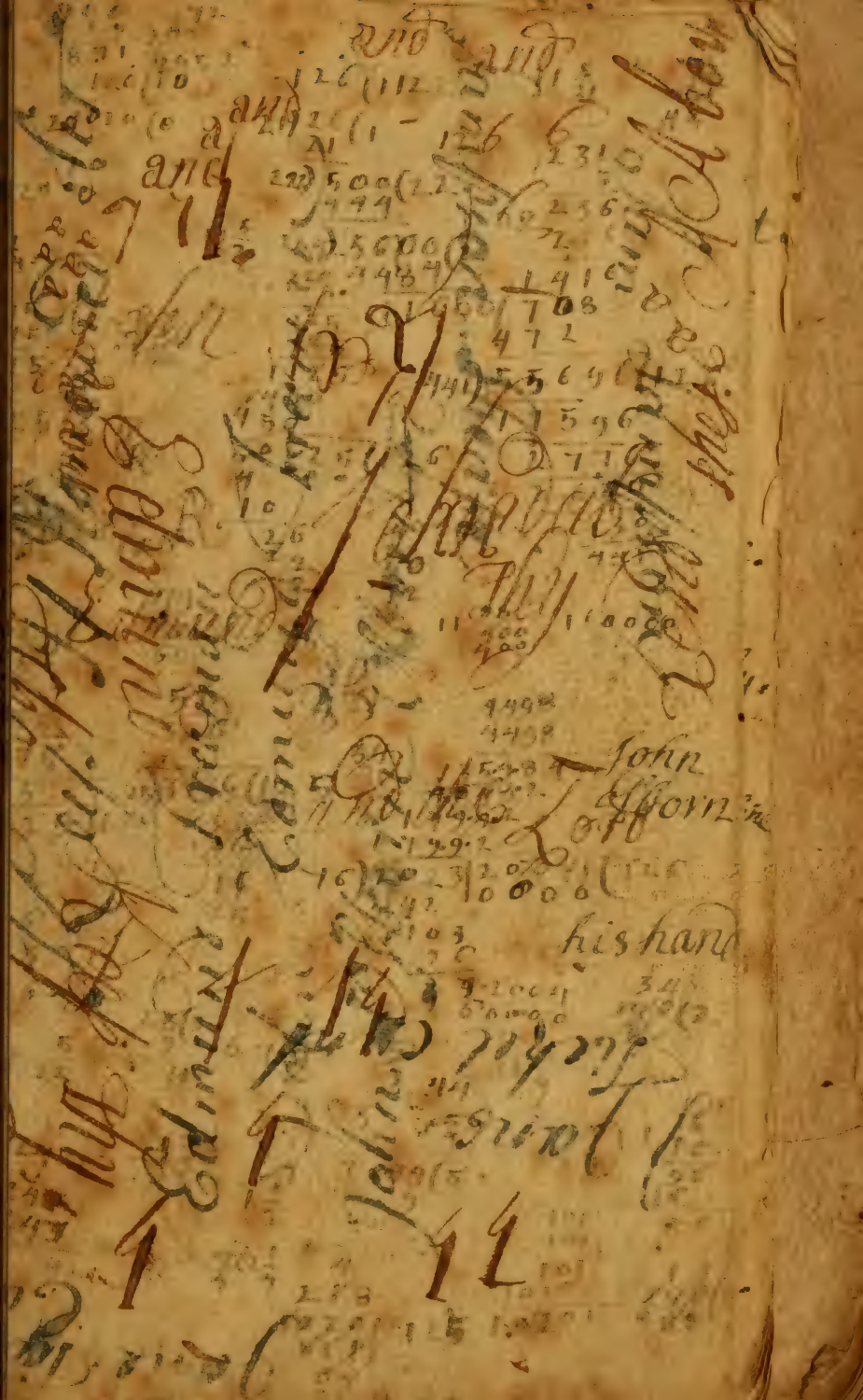
From the Albany Advertiser.

[The following lines were spoken by some of the Children educated at the British Asylum for the Deaf and Dumb, at the anniversary of the Patrons of that institution, in April, 1800.]

THE DEAF and DUMB thro' Britain's Isle,
The bounty you dispense partake:
Your's is the honor to have rais'd
The first Asylum for their sake.
Nor think the objects of your care
Unconscious of the good you give—
We feel and know the happy truth,
That great's the blessing we receive.
And could we open to your view
The feelings of a mind oppressed
With anxious cares—with joys—or woes—
By dumbness cruelly suppress'd;
Then would you highly prize with us,
The bliss by your Asylum given;
Nor scorn the feeble voice that lisps
Our gratitude—to you—and heaven.

ON WAR.

WHENE'ER contending powers fight
For private pique or public right:
Armies are rais'd, the fleets are mann'd,
They combat both by sea and land
Then after many battles pass'd,
Both tir'd with blows make peace at last:
What is it, after all, the People get?
Why—Widows, Taxes, Wooden Legs and Debt.



Quid est finis summus hominis?

finis maximus hominis est deum honorificare & illo in eternum frui.

Quam regulam dedit deus ostendendi nobis quomodo glorificemus & fruamur illo

verbum dei, scripturis, veteris & novi testamenti cõtentum, Sola regula est nobis ostendere quomodo glorificamus & fruamur illo.

Quid, Scripturæ, maximé, docent?

Scripturæ precipuè docent, quid homo debet credere de deo & quod officium deus ab hominibus requirit.

Quid est deus? John Osborn

Deus est Spiritus infinitus æternus & immutabilis, in essentia ejus

Sapientia potestas sanctitas justitia bonitas & veritas. John

An sunt dei plusquam uno?

est nisi unus solum, vivens & verus deus.

Quot sunt in deitate personæ

Somtime in february in the year
1731 I wrote the following lines, as
I was reading Miltons Paradise lost.

brought death into ye world & all our woe.
— — — him th almighty powr
hurld headlong flaming from th etherial sky.
no light but rather darkness visible
serv'd only to discover sights of woe.
cloathd with transcendent brightness didst outshine
or do his errands in the gloomy deep.
— — — and the thunder
wing'd with red lightning & impetuous rage.
— — — — void of light
save what ye glimring of these livid flames
casts paile & dreadfull. — — — —
with head uplift above the wave, & eys
that sparkling blazd; his other parts beside,
prone on the flood extended long & large,
lay floating many a rood.
Created hugest that swim ye ocean stream.
invests all ye sea & wisht morn delays.

then with expanded wings he steers his flight
aloft incumbent on the dusky air.
— — — — fairwell happy fields
where joy forever dwells! hail horrors! hail
infernal world! & thou profoundest hell,
— — — — — — in my choice
to reign is worth ambition though in hell.
thick as autumnal leaves that strow the brooks
in Vallombrosa where the Etrurian shades.
he cald so loud yt all the hollow deep
of hell resounded.
awake arise, or be forever fall'n!
like night & darkend all yt land of Nile.
— — — — — and spread
beneath Gibraltar to the Lybian sands.
& over the Celtic roamed the utmost isles.
at wc. yt universal host upsent
a shout that tore hells concave & beyond
frighted yt reign of Chaos & old Night.
hurling defiance toward yt vault of heaven.
— — — — — and with yt setting sun
dropd from the Zenith like a falling star
on Lemnos th' Aegean isle.
beyond yt indian mount & fairy Elves.
millions that stand in arms & longing wait
the signal to ascend sit lingring here.
— — — — and for their dwelling
accept this dark opprobrious den of shame.
wc. if not victory is yet revenge.
those thots yt wander thro' eternity
to perish rather swallowd up & lost
in the wide womb of uncreated night.

who shall attempt with wandring feet
the dark unbottomd infinite abiss,
through ye palpable obscure find out
his uncouth way; or spread his aery flight, 40
upborn with indefatigable wings,
over ye vast abrupt ere he arrive ye
the happy Isle.
— — — & gates of burning adamant
barrd over us prohibit all egress.
their rising all at once was as ye sound
of thunder heard remote.
as when from mountain tops ye dusky clouds
ascending while the north wind sleeps ore
Heavens chearfull face, the lowring element
powrs downe the darkend landscape snow or shour
if chance the radiant sun with farr shed beam
extend his evning beam, the fields revive,
the birds their notes renew, & bleating herds
attest their joy, that hill & valley rings.
— — — the hollow abiss
heard far and wide, & all the host of hell
with deafning shout returnd them loud acclaim
for eloquence, ye soul, song charms ye sence.
— — — with one small drop to loose
in sweet forgetfulness all pain & woe.
with shivring horror pale & eys agast.
Rocks, caves, lakes, fens, bogs, dens, & shades of death.
where all life dies, death lives, & nature breeds,
perverse, all monstrous all prodigious things
abominable, inutterable & worse
than fables yett have feignd or fear conceivd

black it stood as night
fierce as ten furies, terrible as hell.
with horrid strides: hell trembled as he strode
to waft eternall days in woe & pain.
— — — I fled & cryd out, death,
hell trembled at the hideous name & sigh
from all her caves & back resounded, Death

Book the 3.

thee I revisit now with bolder wing,
escaped the stygian pool tho long detaind.
yet not the more
Cease I to wander where the muses haunt
Clear spring, or shady grove or sunny hill.
smit with y^e love of sacred song: but chief
thee sion, & y^e flowry brooks beneath
that wash thy hallowd feet & warbling flow.
thus with y^e year
seasons return, but not to me returns
day, or the sweet approach of even, or morn
or sight of vernal bloom, or summers rose
in the happy garden placd,
reaping immortal fruits of joy & love
uninterrupted joy unrivald love
in blissful solitude.
his words here ended but his meek aspect
silent yet spake, & breathd immortal love.
the multitude of angels with a shout
loud as from numbers without number; sweet
as from blest voices, uttering joy, heavn rung
with jubile & loud hosannas filld
Th, eternall regions.
in purple with celestial roses smild.

As when a vulture on Imaus bred,
Whose Snowy Ridge the roving Tartar bounds
Dislodging from a region scarce of prey
To gorge the flesh of lambs or yeanling kids
On hills where flocks are fed, flies toward the Springs,
Of Ganges or Hydaspes Indian streams.
But in his way, lights on the Barren plains
Of Sericana where Chineses drive
With Sails & winds their carry wagons light.
Into the higher than that wall a circling row
Of goodliest trees loaden with fairest fruit,
Blossoms & fruits at once of golden hue
Apeard, with gay enamelled colours mixt:
On which the sun more glad impress his beams
Than in fair evening cloud, or humid bow,
When god hath showrd the earth, so lovely seemd
That landskip: & of pure now purer air
Meets his approach, and to the heart inspires
Vernal delight & joy able to drive
All sadness but despair: now gentle gales
Fanning their odoriferous wings dispense
Native perfumes, & whisper whence they stole
Those balmy spoils.

— from that Saphire fount the crisped brooks,
Rowling on Orient pearl & sands of gold,
With mazie error under pendant shades
Ran Nectar, visiting each plant, & fed
Flours worthy of Paradise.

— thus was this place
A happy rural seat of various view;
Groves whose rich trees wept odorous gums & balm,
Others whose fruit burnisht with golden rind
Hung amiable, Hesperian fables true,
If true, here only, and of delicious taste:

Betwixt them lawns, & level downs, & flocks
Grazing the tender herb, were interpos'd,
Or palmy hillock, or the flowry lap
Of some irriguous valley spread her store,
Flowrs of all hue, & without thorn the rose:
Another side, umbrageous grotts & caves
Of cool recess, over which the mantling vine
Lays forth her purple grape, & gently creeps
Luxuriant; meanwhile murmuring waters fall
Down the slope hills, disperst, or in a lake,
That to the fringed bank with myrtle crownd,
Her crystal mirror holds, unite their streams.
The birds their quire apply; airs, vernal airs,
Breathing the smell of field & grove, attune
The trembling leaves, while universal Pan
Knit with the graces & the hours in dance
Led on the Eternal Spring.
Two of far nobler shape, erect & tall,
Godlike erect, with native honour clad,
In naked majesty, seemd lords of all.
For contemplation he & valour formd,
For softness she & sweet attractive grace.
His fair large front & eye sublime declard
Absolute rule, & hyacinthin Locks
Round from his parted forelock manly hung
Clustring, but not beneath his shoulders broad.
She as a vail down to the slender waist
Her unadorned golden tresses wore
But wavd in wanton ringlets which implyd
Subjection, but requird with gentle sway,
By her yieldee, by him best received,
Yieldee with coy submission modest pride,
And sweet reluctant amorous delay.
So past they naked on, nor shund the sight
Of god or angel, for the thought no ill.

under a tuft of shade that on a green
stood whispering soft, by a fresh fountain side,
They sat them down. ——————
The savoury pulp they chew; & in the rind
Still as they thirsted, scoop the brimming stream.
—— —— —— —— for the sun
Declind was hasting now with prone career
To th Ocean ~~Iles~~ Isls, & in th ascending scale
Of heavn the stars that usher evning rose.

Tres personæ in deitate sunt, pater, filius & Spiritus Sanctus, & hi tres sunt unus deus, idem in substantia in potestate & gloria æquales.

Quæ sunt decreta dei,

Decreta Dei sunt ejus eterna determinatio secundum consilium voluntatis suæ, quæ in suam gloriam præordinavit quicquid contingit vel existit.

Quomodo deus decreta ejus executus est.

Deus decreta executus est, operationibus creationis & providentiæ.

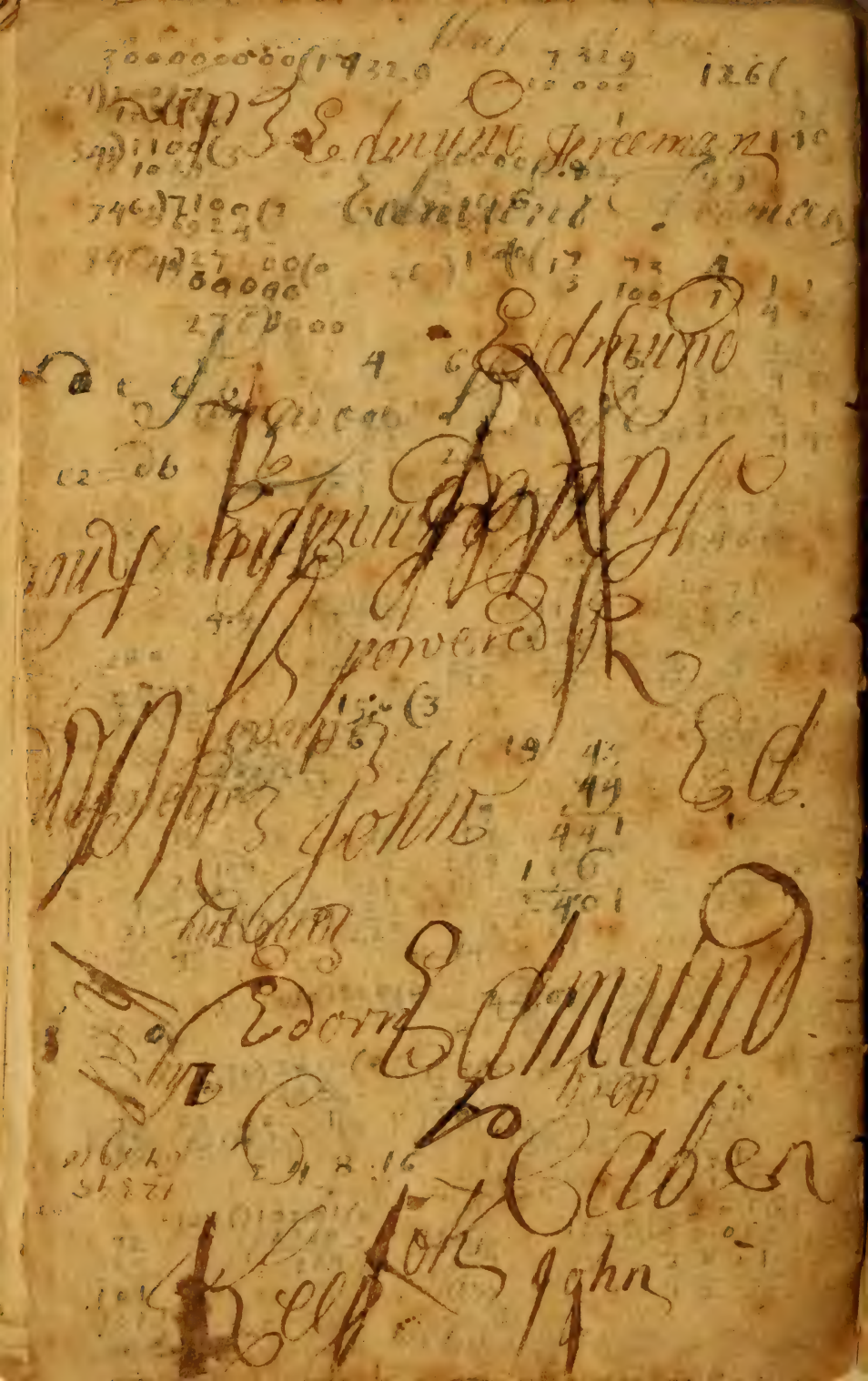
Quid est opus creationis?

opus creationis est ~~creatio~~ Dei faciens omnium ex nihilo, ~~Dea~~ per verbum potestatis ejus spacio sex dierum, & omnia valde bona.

Quomodo creavit deus hominem?

Deus marem & feminam; hominum creavit

John Osborn his Name & Book
alias book and



An Introduction to the Doc=
=trine of Fluctions, or the Arith=
metick of Infinites in order to affift
the Imagination in forming Concep=
=tions of the Principles on which
that Doctrine is founded.

As I found it difficult for me
to form clear & diftinct conceptions
of the principles, on which the Doctrine
of Fluxions or the Arithmetick of Infi=
=nites is founded, I Reduced Some years
Since, my thoughts on that Subject to
writing; that I might thereby more
attentively conſider them, and their
congruity with what has been de=
=liv delivered by the author of that
Method.

Theſe Difficultys I then attri=
buted to the weakneſs of my own Ima=
=gination & Judgment. but having
lately found that Biſhop Berkley in his
treatiſe called the Analyſt, has decla=
=red to the world his Opinion in the fol=
=lowing words

"That Sr Iſaac Newton's
"Demonſtration of the Doctrine of Flux=
"ions is defective, and that he (Sr Iſaac)
"was not quite pleaſed with it himſelf.—

The

From Doct.
Cadwallader Golden
of N. York.

"The various inconsistant accounts
"which this great Author gives of his
"Momentums & his Fluxions may
"convince every intelligent reader, that
"he had no clear & steady notions of
"them, without which there can be no
"demonstration."

The Bishop declares "this to be his
"opinion, after he had taken as much
"pains as (he sincerely believes) any
"man living to understand that great
"Author & to make sense of his Prin=
="ciples".

The Bishop likewise adds what follows.
"that having freely conversed with Ma=
="thematicians of all ranks, & some of
"the ablest Professors, as well as made
"it my business to be informed of the O=
="pinion of others, being very desirous to
"hear what could be said, toward clear=
="ing my difficulties, or answering my ob=
="jections. I do solemnly affirm (and
"many of themselves know it to be true)
"that I found no harmony or agree=
="ment among them; but the reverse
"thereof, the greatest dissonance, &
"even contrariety of opinions employ=
="ed to explain what after all seemed
"inexplicable.

These

These things I say, make me think, that the difficulties I found, were really in the Subject, or in the method which the authors had taken to convey their conceptions; Since So great & acute a Phylosopher, as the Byshop is allowed to be, after So many years Study, Still allows that he can form no conception of the principles on wc. the method of Fluxions is founded.

I resolved therefore to examine my former thoughts with my pen in my hand, to assure my Self that I had not Slightly, or with too fond an opinion of my own conceptions rested Satisfyd in what I formerly had done; and now I remain So far convinced that Sr Isaac Newton had clear & distinct conceptions of his own Principles (of which indeed I could not doubt while I had no conceptions my Self) That I cant forbear wishing to have an opertunity of Submitting to the Byshop, the manner in which I have considered this Subject: for often one receives a conception by one method of conveyance, which he could not by another.

The Result of my work was as Follows,

1. The

I. The Idea or Conception of Finite & Infinite arife from the comparing of two or more quantities together for if the cannot be compared, or have nothing in common of which it may be faid both are equal, or one contains more or the other lefs, they cannot be faid either to be finite or Infinite with refpect to each other.

Thus Space & time are neither finite nor Infinite with refpect to each other, becaufe they have nothing in common, of which it can be faid the one has more or lefs than the other; or no part of the one can meafure any part of the other, by which the ratio of the one to the other can be determined to be either finite or infinite, determinable or Indeterminable, equal, greater, or lefs.

2. When on comparing two quantities, we evidently perceive that the leaft, by multiplication or addition, can be made equal to or greater than the greateft, or that the greateft, by Diviſion or Subftraction, can be made equal to or lefs than the leaft, we fay thefe two quantities are finite; In the moft common acceptation of the word finite, both, or one of thofe quantities or their common meafure at leaft by which we compare them, comes within the compafs of our Senfes, that is, tis neither too little nor too great for our conception to form a diftinct image of it. 3.

3. But when, on comparing two quantities, we clearly perceive that the one is so much less or greater than the other, that no multiplication of, or addition to, the least, can make it equal to, or greater than, the other, or no division or subtraction of or from the greatest can make it so small as the least; we say, these two quantities are Infinite with respect to each other. In the common acceptation of the word, that one of the two, which comes within the compass of our Senses, or which may be measured by some quantity which falls within the compass of our Senses, or may be measured by some determinable part of such quantity, is finite, and the other we call infinite, whether it be the greatest or the smallest.

Thus, time & Eternity have something in common by which they may be compared, viz. the Quantity of Duration in each: but, in that comparison, we evidently perceive, that time, however multiplied or increased, can never be equal to Eternity. No number of Hours, no number of Years, No Number of Ages, no number of Centuries can equal Eternity. Again, any determined Space & universal Space agree in extension, but no quantity of any determined Space, however multiplied or increased can equal universal Space.

The

The Space which the Solar System occupys can as little by any multiplycation, become equal to universal Space as a cubic Inch of Space can become equal to it. Yet it is evident, that an hour a year & an Age are all component parts of Eternity: So likewise every finite or determinate Space is a component part of Universal Space.

4. In considering therefore Infinite Quantities, the things compared have a relation, one to the other or have something in common between them, greater in the one than in the other: but that the quantity of this thing in common, in one exceeds the other, so far that the ratio of this excess is greater than any that can be determined, or that they never can bear any Proportion the one to the other.

So that,

The Perception of this Relation between the quantities & likewise the clear perception that it can bear no proportion in the one to the other, are both Essential to the Conception of Infinite.

Thus

Thus far our Conception of Infinite, I think agrees with the commonly received notion of it. Our nex enquiry shall be whither this conception agree, with that commonly received by Mathematicians: or whither they have the same Idea when they say, one Quantity is infinite in Relation to another: or whither Infinite in this Sense can be the Subject of Mathematical Enquiry.

To Show that Mathematicians have the same conception of Infinites I shall take the 16 Prop. of the 3d book of Euclids Elements. viz.

The Angle comprehended between the Tangent & Circumference of a Circle, is less than any acute Angle: & the Angle between the diameter and circumference is greater than any acute Angle, and at the same time less than any right Angle.

Therefore I Say, the angle of Contact, comprehended between the Tangent & circumference, is infinitely Small, in respect to any acute right lined Angle whatsoever: for if it be not it may (by 2d above) by being multiplied by Some finite number, become equal to a right lined Angle, Suppose equal to A, Then divide the finite right lined angle A, by that number, a right lined (acute) angle may by this division be produced equal to the angle of Contact; which is absurd

which is absurd, being contrary to what Euclid has demonstrated. Since then no multiplication of the angle of contact can make it equal to any right-lined angle whatsoever, it muſt (by 3d) be infinitely small.

But the ratio of the angle, at the point of Contact, made by the Circumference & any right line falling within it, to any other right lined angle A, will be the same with the ratio of the angle made by the Tangent & that Straight line falling within the circumference, to the angle A. If you say it is not, another right lined angle B may be made, which shall have the same ratio to the angle A that the 2d angle made by the Circumference & a line falling within it, has.

But in this case the difference between the angles made by the Tangent & the line falling within the circumference & the angle B will be equal to the angle of contact, and consequently the angle of Contact may be determined to be equal to a right lined (acute) angle: which is absurd, being contrary to what Euclid has demonstrated. Therefore

5. The addition or Subftraction of any infinitely Little or of any number of infinitely Littles to or from a finite, does not alter the ratio of that finite to any other finite.

Now tis a very evident propofition as any in geometry, that all the angles of any polygon, inferibed in a circle, are equal to twice the number of right angles, which that polygon has Sides, after four right angles are deducted from the Sum or product. That is, calling the number of Sides, n & a right angle 90° then $2n \times 90° - 360° = S$ the Sum of the angles. Let the ~~n~~ Sides of the polygon be ever So many while the number remains finite, the angle which any two of thefe Sides makes may be determined. It follows then that the parts of a circumference which compofe the Several angles or bendings thereof, muft be infinitely Small, and the number of angles infinitely great; for, till n becomes infinite, the ratio of any angle of the polygon to a right angle, or to any other angle can alwife be determined; & if it can be determined it muft be either acute, right angled, or obtufe, & the angle of contact muft confequently be determined.
But by confidering that the angles of a polygon grow more & more obtufe as the number

John Storms.

Decembr. ye 1st Anno 1733

An horse for £5, a Mare for 15s, a Colt for 5s, how many of each sort may be bought for 20£?

Data $5a+\frac{3}{4}e+\frac{1}{4}y=20$
let $a=1$, then $\frac{3}{4}e+\frac{1}{4}y=15$
$3e+y=60$

a	e	y
1	19	3
	18	6
	17	9
	16	12
	&c. to	
	1	57

let $a=2$ then $\frac{3}{4}e+\frac{1}{4}y=10$
$3e+y=40$

a	e	y
2	13	1
	12	4
	11	7
	&c. to	
	1	37

let $a=3$
then $\frac{3}{4}e+\frac{1}{4}y=5$
$3e+y=20$

a	e	y
3	6	2
	5	5
	4	8
	&c. to	
	1	17

The Specifick weight of metals.

Gold	19635	Iron	7852
Quickfilver	14019	Tin	7321
Lead	11341	Stone	2000
Silver	10513	water	1000
Copper	8843	air	$\frac{3}{17}$

A Cubic inch of

	weighs	ounces.	drams.	grains.
Gold		12	2	52
Quickfil.		8	6	8
Lead		7	3	30
Silver		6	5	28
Copper		5	6	36
Iron		5	1	24
Tin		4	6	17

The Sealed Gallon at Guild-Hall, which is the Standard for wines Spirits, &c.

Contains 224 Cubic inches; tho' it is commonly Supposed to contain 231 after which the Smaller measures are made.

Beer Measure, 272½ Cubic inches make one gallon.

A Buffhel contains 2178 cubic inches, equal to 8 beer gallons

To find all the whole numbers a & b, that are capable of producing this Equation $8a+97=5b$. or this $601a+9=200b$.

$\frac{601a+9}{200}=b=$ integ.

$\frac{a+9}{200}=$ integro

hence, a, may $=191$, or 391, or 591. &c.

$8a+97=5b$

$\frac{8a+97}{5}=b=$ integ.

$\frac{3a+2}{5}=c=$ integro

$5c=3a+2$

$\frac{5c-2}{3}=a=$ integ.

$\frac{2c-2}{3}=$ integ. $=d$

$2c-2=3d$

$\frac{3d+2}{2}=c=$ integ.

$\frac{d}{2}=$ integro, hence d may $=$ any even number. & $2\frac{1}{2}d+1=a$

In this Series

0. 1. 4. 9. 16. 25.

Let $N=$ the number of terms, $L=$ the root of the last term, $S=$ the Sum of all the terms.

then $\frac{NLL}{3}+\frac{NL}{6N-6}=S$

And in this Series

0. 1. 8. 27. 64. &c.

$\frac{NLLL}{4}+\frac{NLL}{4N-4}=S.$

The Solution of Adfected Quadratick Equations. From Wards Algebra.

	1	$aa+2ba=dc$. Case 1st.
put	2	$a+b=e$
2 @ 2	3	$aa+2ba+bb=ee$
3 — 1	4	$bb=ee-dc$
4 + dc	5	$ee=bb+dc$
5 w. $\sqrt{}$	6	$e=\sqrt{bb+dc}$
2 and 6	7	$a+b=\sqrt{bb+dc}$
7 − b	8	$a=\sqrt{bb+dc}-b$

	1	$aa-2ba=dc$. Case 2d.
put	2	$a-b=e$
2 @ 2	3	$aa-2ba+bb=ee$
3 — 1	4	$bb=ee-dc$
4 + dc	5	$ee=bb+dc$
5 w. $\sqrt{}$	6	$e=\sqrt{bb+dc}$
2 and 6	7	$a-b=\sqrt{bb+dc}$
7 + b	8	$a=\sqrt{bb+dc}+b$

	1	$2ba-aa=dc$ Case 3d
put	2	$b-a=e$
2 @ 2	3	$bb-2ba+aa=ee$ & $b^2=e^2+2ba-a^2$
1 + 3	4	$bb=ee+dc$
4 − dc	5	$ee=bb-dc$
5 w. $\sqrt{}$	6	$e=\sqrt{bb-dc}$
2 & 6	7	$b-a=\sqrt{bb-dc}$
	8	$a=b-\sqrt{bb-dc}$

This Method holds good also in Other Equations where there are but two powers of the unknown Quantity & one of them double to the Other. as in the Example over the leaf in the next page.

2

	1	$a^6+2ba^3=dc$
put	2	$a^3+b=e$
2 ⊙	3	$a^6+2ba^3+bb=ee$
3−1	4	$bb=ee-dc$
4+dc	5	$ee=bb+dc$
5 ww$_2$	6	$e=\sqrt{bb+dc}$
2 & 6	7	$a^3+b=\sqrt{bb+dc}$
7−b	8	$a^3=\sqrt{bb+dc}-b$
8 ww$_3$	9	$a=\sqrt[3]{\sqrt{bb+dc}-b}$

Their Resolution by Compleating the Square. As

	1	$aa+2ba=dc$ Case 1st.
certain	2	$bb=bb$
1+2	3	$aa+2ba+bb=dc+bb$
3 ww$_2$	4	$a+b=\sqrt{dc+bb}$
4−b	5	$a=\sqrt{dc+bb}-b$

	1	$aa-2ba=dc$ Case 2d.
	2	$bb=bb$
1−2	3	$aa-2ba+bb=dc+bb$
3 ww$_2$	4	$a-b=\sqrt{bb+dc}$
4+b	5	$a=\sqrt{bb+dc}+b$

	1	$2ba-aa=dc$. Case 3d
1±	2	$aa-2ba=-dc$
then	3	$aa-2ba+bb=bb-dc$
3 ww$_2$	4	$a-b=\sqrt{bb-dc}$
4+b	5	$a=\sqrt{bb-dc}+b$.

and this method is good also in those other Equations. ots for Example

	1	$a^4+2ba^2=dc$
	2	$bb=bb$
1+2	3	$a^4+2ba^2+bb=dc+bb$

3 w$_2$	4	$a^2+b=\sqrt{bb+dc}$
4−b	5	$a^2=\sqrt{bb+dc}-b$
5 w$_2$	6	$a=\sqrt{:\sqrt{bb+dc}:}-b$

And after the Same manner for all the other Cases.

Every Adfected Equation hath as many roots as its dimenſions are (viz) the index of its higheſt power. Therefore the quantity a. in this Equation $aa+32a=4644$ hath 2 values; & when one is found by the method above, the other may be found by diviſion thus. Since $a=54$ $a-54=0$ and $aa+32a-4644=0$

$$\text{now } \frac{aa+32a-4644=0}{a-54=0} = a+86=0$$

And this Equation $36a-aa=243$ has 2 affirmative roots, & is called ambiguous, for but one will truely anſwer the queſtion. the roots of this Equation are 9, and 27.

Mr. Ralphſons Theorems for extracting the roots of Simple powers.

For the Square, let $a^2=N$. $\frac{N-g^2}{2g}=x$

For the Cube, $a^3=N$. $\frac{N-g^3}{3g^2}=x$.

Biquadrate, $a^4=N$. $\frac{N-g^4}{4g^3}=x$.

Surſolid, $a^5=N$, $\frac{N-g^5}{5g^4}=x$. &c.

4)

Wards Theorems for extracting the Square & Cube roots.

	1	$aa = G.$
	2	$r + e = a.$
2@^2	3	$rr + 2re + ee = aa = G.$
$3 - rr$	4	$2re + ee = G - rr.$
$4 \div 2r + e$	5	$e = \frac{G - rr}{2r + e}.$

	1	$a^3 = G.$
	2	$r + e = a.$
2@^3	3	$rrr + 3rre + 3ree + eee = a^3 = G.$
$3 - r^3$	4	$3rre + 3ree = G - rrr.$
$4 \div 3r$	5	$re + ee = \frac{G - rrr}{3r} = D.$
$5 \div r + e$	6	$e = \frac{D}{r + e}.$

Note, that e^3 is left out as of no value.

Dr. Halleys universal Theorems which answer all cases, in all powers whatsoever, with more ease & expedition than any other. The one he calls Rational, the other Irrational: and they may be used promiscuously in the same Example, or Just as the Algebraist thinks fit, for they are only so called because one performs without extraction, the other with.

The Rational. $x = \frac{b}{c + \frac{db}{c}}.$

The Irrational. $x = \frac{\sqrt{bd + \frac{1}{4}cc} - \frac{1}{2}c}{d}.$

In using these Theorems, observe always for the Absolute number to put b, for that which is multiplyed into the Simple root c, that of the Square d, and if there be any more Coefficients throw them out, or not regard them, and the answer will come exact; or if the coefficients be less, omit in the Theorem the letter that answers to them.

Ex. 1st. To find one of the affirmative values of x, in this Affected Cubick Equation,

$$xxx+438xx-7825x-98508430=0$$

let $g+a=x$ & $g=300$ then is

$$x^3=27000000+270000a+900aa+a^3$$
$$438x^2=39420000+262800a+438aa$$
$$-7825x=-2347500-7825a$$
$$-N=-98508430$$

$$Sum=-3443593\,0+124975a+1338aa+a^3$$

Which last put into the letters of the Theorem is, $-b+ca+daa+aaa=0$. or

$ca+daa+a^3=b$. then by the rational Theorem it is thus, $a=\frac{b}{c+\frac{db}{c}}=56$

Then $g+a=356=x=$ first aproach

Now let $g=356$, & $g+a=x$

Then is

6) Then is,

$x^3 = aaa + 1068aa + 380208a + 45118016$
$438x^2 = 438aa + 311856a + 35510368$
$-7825x = \ldots\ldots - 7825a - 2785700$
$-N = \ldots\ldots - 98508430$

Sum. $aaa + 1506aa + 684\overset{2}{2}\overset{3}{3}9a - 665746.$

that is, $aaa + daa + ca = b$

$$a = \frac{b}{c + \frac{db}{c}} = 0,970896.$$

then $356 + 0,970896$

$356,970896 = x$

Exam. 2. what is the value of x in this Adfected Biquadratick?

$x^4 - 80x^3 + 1998xx - 14937x - 5000 = 0$

let $g + a = x$. & $g = 8$

then $x^4 = a^4 + 32a^3 + 384a^2 + 2048a + 4096$
$-80x^3 = -80a^3 - 1920a^2 - 15360a - 40960$
$1998x^2 = \ldots + 1998a^2 + 31968a + 127872$
$-14937x = \ldots - 14937a - 119496$
$-N = \ldots\ldots - 5000$

Sum $= a^4 - 48a^3 + 462a^2 + 3719a - 33488$

$a^4 - ca^3 + daa + ca - b = 0$

$a = \frac{b}{c + \frac{bd}{c}} = 4$, then $x = 8 + 4 = 12$. let $g = 12$ and $g + a = x$.

then

$x^4 = a^4 + 48a^3 + 864a^2 + 6912a + 20736.$
$-80x^3 = -80a^3 - 2880a^2 - 34560a - 138240.$
$1998x^2 = \text{----} + 1998a^2 + 47952a + 287712.$
$-14937x = \text{------} - 14937a - 179244.$
$-N = \text{---------} - 5000.$

Sum $= a^4 - 32a^3 - 184a^2 + 5367a - 14036.$

$a^4 - ea^3 - da^2 + ca - b = 0$

$a = \frac{b}{c + \frac{bd}{c}} = 2$ then $g + a = 14$

now let $g = 14$

$g + a = x$

then $x^4 = a^4 + 56a^3 + 1176a^2 + 10976a + 38416.$
$-80x^3 = -80a^3 - 3360a^2 - 47040a - 219520.$
$1998x^2 = \text{---} + 1998a^2 + 55944a + 391608.$
$-14937x = \text{---} - 14937a - 209118.$
$-N = \text{---} - 5000.$

Sum $= a^4 - 24a^3 - 186a^2 + 4943a - 3614.$

$a^4 - ea^3 - da^2 + ca - b = 0$

$a = \frac{b}{c + \frac{bd}{c}} = 0,73102.$

Then $\begin{array}{r} 14 \\ +0,73102 \\ \hline \end{array}$

$g + a = 14,73102 =$ value of x, nearly.

Newtons Method of determining the Uncia of the powers of binomial quantitys.

Let m be the exponent of the any power: then will

$1 \times \frac{m-0}{1} \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} \times \frac{m-4}{5} \times$

$\frac{m-5}{6} \times \frac{m-6}{7} \times \frac{m-7}{8} \times \frac{m-8}{9}$ &C. be a Series for the uncia of any binomial involv'd infinitely. Thus to raise $a+b$ to the 7th power, the m, will equal 7 & by the theorem,

$1 \times \frac{7-0}{1} = 7$ = to the uncia of the 2nd term, & $7 \times \frac{7-1}{2} = 21$ the uncia of the third term, & $21 \times \frac{7-2}{3} = 35$ the uncia of the 4th term & $35 \times \frac{7-3}{4} = 35$ = to the uncia of the 5th term. & $35 \times \frac{7-4}{5} = 21$ = to the uncia of the 6th term, & $21 \times \frac{7-5}{6} = 7$ = to the uncia of the 7th term. & $7 \times \frac{7-6}{7} = 1$ = the uncia of the laft term. So that the 7th power of $a+b$ will Stand thus,

$a^7 + 7ba^6 + 21b^2a^5 + 35b^3a^4 + 35b^4a^3 + 21b^5a^2 +$
$+ 7b^6a + b^7a$

Ward's Theorems for Geometrick progressions.

Let $\begin{cases} a = \text{the first term.} \\ y = \text{the last term.} \\ e = \text{the common ratio.} \\ S = \text{the Sum of all the terms.} \end{cases}$

Then is $S-y$ = to the Sum of all the antecedents, & $S-a$ = to the Sum of all the Consequents.

Then	1	$a : ae :: S-y : S-a$
ergo	2	$Sa-aa = aeS-aey$
$2 \div a$	3	$S-a = eS-ey$
$3+ey$	4	$S-a+ey = eS$
$4-S$	5	$ey-a = eS-S$
$5 \div e-1$	6	$\frac{ye-a}{e-1} = S$
$3 \div S-y$	7	$\frac{S-a}{S-y} = e$
$5+a$	8	$ey = eS+a-S$
$8 \div e$	9	$y = S + \frac{a-S}{e}$
	9	$\frac{eS+a-S}{e} = y$
$4+a$	10	$S+ey = eS+a$
$10-eS$	11	$S+ey-eS = a$

---

let t, = the number of terms, & then will

$$a \times e^{t-1} = y$$

His Theorems for Arithmetik Progressions.

Let $\begin{cases} a = \text{the first term.} \\ y = \text{the last.} \\ e = \text{the common excess.} \\ N = \text{the number of all the terms} \\ S = \text{the Sum of all the Series} \end{cases}$

Then $\frac{Na+Ny}{2} = S.$ $\frac{y-a}{N-1} = e.$

$\frac{y+e-a}{e} = N.$ $\frac{2S-Na}{N} = y.$

$\frac{2S-Ny}{N} = a.$ $\frac{2S}{a+y} = N.$

$\frac{yy-aa}{2e} + \frac{a+y}{2} = S.$ $\frac{yy-aa}{2S-a-y} = e.$

$Ne+a-e = y.$ $y+e-Ne = a.$

His theorems for Simple interest

Let $\begin{cases} P = \text{the principall.} \\ R = \text{the ratio per cent. per annum} \\ t = \text{the time of its continuance.} \\ A = \text{the amount of principal and interest.} \end{cases}$

Then

as $1 lib. : tR :: P : tRP$ = to the interest of P.

then $tRP + P = A$. & $\frac{A}{tR+1} = P$.

$\frac{A-P}{tP} = R$. $\frac{A-P}{RP} = t$.

For Compound interest.

Let $\begin{cases} P = \text{the principal.} \\ t = \text{the time of its Continuance.} \\ A = \text{the amount of prin. \& inter.} \\ R = \begin{cases} \text{the amount of one pound \& its} \\ \text{interest for one year at any} \\ \text{given rate.} \end{cases} \end{cases}$

Which may be thus found,

as $100 : 106 :: 1 : 1,06$ = to the amount of one pound, for one year, at 6 per cent.

or, as $100 : 105 :: 1 : 1,05$ = to the amount of one pound for one year at 5 per cent. and so on for any other rate.

Then if R = the amount of 1l. for 1 year will R^2 = the amount of one pound for 2 years & R^3 = the amount of one pound for 3 years.

for $1 : R : R^2 : R^3 : R^4$ &c. are in ÷

that is { as one pound: is to the amount of one pound at one years end :: So is that amount: to the amount of one pound at 2 years end, & So on in ∴ .

Whence it is plain, Compound interest is grounded upon a Series of terms increasing in Geometrical proportion continued; where in t, (viz^t. the number of years) does always assign the index of the last term; (viz.) the power of R which is R^t.

Again as $1 : R^t :: P : PR^t = A$ = to the amount of P for the time that R^t is equal to the amount of one pound.

That is. as one pound: is to the amount of one pound for any given time :: So is any proposed principal or Sum: to its amount for the same time. Whence follow these Equations.

$$PR^t = A. \quad \frac{A}{R^t} = P. \quad \frac{A}{P} = R^t$$

Dr. Cheyne's Lemmas, for Geometrick progressions.

Let $\begin{cases} a = \text{the first term.} \\ v = \text{the last term.} \\ \frac{s}{r} = \text{the common ratio.} \\ t = \text{the number of terms.} \\ z = \text{the Sum of all the terms.} \end{cases}$

$$v = \frac{s^{t-1}}{r^{t-1}} \times a \qquad sz + ra = rz + vv$$

$$z = \frac{ra - sv}{r - s}$$

From Greenwoods Algebra.

To find all the divisors of any number or quantity.

Divide the number proposed by all the prime numbers: begining with 2, divide by it, as often as can be done without a remainder; then the last quotient by 3, in the same manner, then by, 5, 7, 11, &c. according as the case requires: then set all the prime divisors at the heads of so many collums, & multiply each into all the numbers on the left hand; which will give all

all the divisors of the P. number. as in the following example there are found 15 divisors that will divide 264 without a remain.

To find the divisors of 264.

264	132	66	33	11	1
2	2	2	3	11	

2	2	2	3	11
	4	8	6	22
			12	33
			24	44
				66
				88
	...			132
				264

To find the divisors of Species.

Divide by Such quantitys as are found in the given quantity: as in these examples.

To find the divisors of aaabc.

aaabc	aabc	abc	bc	c	1
a	a	a	b	c	

a	a	a	b	c
	aa	aaa	ab	ac
			aab	aac
			aaab	aaac
				cb
				cab
				caab
				caaab

Ex. 2nd. To find the divisors of $aacb - abbc$.

$aacb - abbc$	$acb - bbc$	$ac - bc$	$a - b$	1
a	b	c	$a-b$	

a	b	c	$a-b$
	ab	ac	$aa-ba$
		bc	$aab-abb$
		abc	$ca-cb$
			$cba-cbb$
			$caab-cabb$

A Few Arithmetical Problems Algebraically Solved.

A certain man finding divers poor persons at his door, gave each of them 3 pence & had 6 pence left: but if he had given them 4 pence apiece he would have wanted 2 pence. How many poor persons were there? And how many pence had he?

let x = the number of persons.
& z = all his pence.

	1	$3x+6=z$
	2	$4x-2=z$
1 & 2	3	$3x+6=4x-2$
$3+2$	4	$3x+8=4x$
$4-3x$	5	$x=8$
		$z=30$

One being asked what a clock it was, answered, that the time then passed from noon was equal to $\frac{33}{40}$ of the time remaining untill mid=night. What was the present hour?

let x = the hour sought.
& z = the remaining.

	1	$x+z=12$
	2	$x=\frac{33}{40}z$
1 & 2	3	$\frac{33}{40}z+z=12$
3×40	4	$33z+40z=480$
	5	$73z=480$
	6	$z=\frac{480}{73}=6\frac{42}{73}$
1 & 6	7	$x=12-6\frac{42}{73}=5\frac{31}{73}$

A Ciftern in a certain Conduit Sup=plied with water by two pipes, will be filled by both the pipes A, & B. in 12 hours, & by the cock A, alone in 20 hours, in what time will the Cock B, fill it?

let $b=12$ hours, & $c=20$, & $x=$ time sought

N.B. the time in which each will fill the Ciftern is to the whole Ciftern, as the time in which both will fill it, is to the part of it filled by each in y^{t} time.

$c:1::b:\frac{b}{c}$

$x:1::b:\frac{b}{x}$

	1	$1=\frac{b}{c}+\frac{b}{x}$ ie. the whole cistern is equal to both its parts.
$1\times c$	2	$c=\frac{bc}{c}+\frac{bc}{x}$
$2\times x$	3	$cx=bx+bc$
$3-bx$	4	$cx-bx=bc$
$\div c-b$	5	$x=\frac{bc}{c-b}=30$ hours

A Cistern is Supplyd with water by 4 pipes whereof the first will fill it alone in two days, the 2d in 3 the 3d in 4. & the 4th in 6 hours. in what time will all together fill it?

$$\text{let}\begin{cases}a=48\\b=12\\c=96\\d=6\end{cases}\text{hours}\quad \&\ x=\text{time Sought.}$$

$a:1::x:\frac{x}{a}$ $\quad c:1::x:\frac{x}{c}$

$b:1::x:\frac{x}{b}$ $\quad d:1::x:\frac{x}{d}$

	1	$\frac{x}{a}+\frac{x}{b}+\frac{x}{c}+\frac{x}{d}=1$ Astern
$1\times abcd$	2	$xbcd+xacd+xabd+xabc=abcd$
$\div bcd+acd+abd+abc$	3	$x=\frac{abcd}{bcd+acd+abc+abd}=4.43'16''$ hours

A man has so many Shillings that $\frac{1}{5}$ of the number multiplied by $\frac{2}{5}$ of the number, will produce the number he has. how many has he?

	1	$\frac{2x}{5}\times\frac{x}{5}=x$
$\frac{1}{5}$	2	$\frac{2xx}{25}=x$
2×25	3	$2xx=25x$
$3\div x$	4	$2x=25$
$4\div 2$	5	$x=\frac{25}{2}=12\frac{1}{2}$

If 10 dozen eggs & 12 pound of butter be Sold for 13 Shillings: and at the Same rate, 8 dozen eggs & 18 pounds of butter, for 16 Shillings. What are the eggs per dozen and the butter per pound?

let $\begin{cases} x = \text{the price of a dozen eggs.} \\ z = \text{the price of a pound of butter.} \end{cases}$

	1	$10x+12z=13$
	2	$8x+18z=16$
$2\div\overline{2}$	3	$4x+9z=8$
then	4	$4x+9z : 8 :: 10x+12z : 13$
ergo	5	$80x+96z=52x+117z$
$5-96z$	6	$80x=52x+21z$
$6-52x$	7	$28x=21z$
$7\div\overline{7}$	8	$4x=3z$
1 & 8	9	$26x=13$
$9\div\overline{26}$	10	$x=\frac{13}{26}=\frac{1}{2}=6$ pence.
2 & 8	11	$24z=16$
$11\div\overline{24}$	12	$z=\frac{16}{24}=\frac{2}{3}=8$ pence.

data eadem

$1\times\overline{3}$	3	$30x+36z=39$
$2\times\overline{2}$	4	$16x+36z=32$
$3-4$	5	$14x=7$
$5\div\overline{14}$	6	$x=\frac{1}{2}=6$ pence
$4-3$	7	$30x=15$ Shillings
$1-7$ & 8		$36z=24$
$8\div\overline{36}$		$z=\frac{2}{3}=8$ pence

A Dog chaseing a fox is an 100 paces behind him, but runs $2\frac{1}{2}$ times So fast as the fox: how far will the fox run before the dog catches him?

let x = the Distance the dog will run.
& z = the Distance the fox will run.

	1	$x-z=100$
	2	$x=2\frac{1}{2}z$
$2\times\overline{2}$	3	$2x=5z$
$1\times\overline{2}$	4	$2x-2z=200$
3 & 4	5	$5z-2z=200$
$5-2z$	6	$3z=200$
$6\div 3$	7	$z=\frac{200}{3}=66\frac{2}{3}$

Three men have each of them a number of Crowns, So that the first mans Crowns together with $\frac{1}{2}$ the 2d mans make an 100, and the 2d mans together with $\frac{1}{3}$ of the 3d mans make an 100, and the 3d mans together with $\frac{1}{4}$ of the first mans make an 100. how many Crowns hath each man?

let $\begin{cases} a = \text{the first}^{s} \text{ money.} \\ b = \text{the } 2^{ds}. \\ c = \text{the } 3^{ds}. \end{cases}$

	1	$a+\frac{b}{2}=100$
	2	$b+\frac{c}{3}=100$
	3	$c+\frac{a}{4}=100$
1 — a	4	$\frac{b}{2}=100-a$
4 × 2	5	$b=200-2a$
2 & 5	6	$200-2a+\frac{c}{3}=100$
6 × 3	7	$600-6a+c=300$
7 — 6a	8	$600+c=300+6a$
8 — 600	9	$c=300+6a-600$
3 & 9	10	$300+6a-600+\frac{a}{4}=100$
10 × 4	11	$1200+24a-2400+a=400$
11 + 2400	12	$1200+24a+a=2800$
12 — 1200	13	$24a+a=1600$
	14	$25a=1600$
14 ÷ 25	15	$a=\frac{1600}{25}=64$

What are the 2 numbers whose difference is 4 and the difference of their Squares 64?

	1	$a-e=4$
	2	$aa-ee=64$
1 + e	3	$a=4+e$
3 @²	4	$aa=16+8e+ee$
2 + ee	5	$aa=64+ee$
4 & 5	6	$16+8e+ee=64+ee$
6 — ee	7	$16+8e=64$
7 — 16	8	$8e=48$
8 ÷ 8	9	$e=6$
1 & 9	10	$a=10$

(let a = the greatest. & e = the least.)

A Vintner having 2 Sort of wine [illegible]
One worth 4, tother 6 pence the quart, would mix 20 quarts So that the mixture might be worth 5 pence the quart. how much muſt he take of each Sort.

Let $\begin{cases} a = \text{the quantity of the cheapeſt.} \\ e = \text{that of the dearest.} \end{cases}$

Data	1	$a+e=20$
	2	$4a+6e=100=20\times 5$
1−e	3	$a=20-e$
2−6e	4	$4a=100-6e$
3×4	5	$4a=80-4e$
4−5	6	$100-6e=80-4e$
6−80	7	$20-6e=-4e$
7+6e	8	$20=2e$
8÷2	9	$e=\frac{20}{2}=10$
or thus		
4−5	10	$0=20-2e$
10+2e	11	$2e=20$
	12	$e=\frac{20}{2}=10$
1&9	13	$a=10$

or thus

Data	1	$a+e=20$
	2	$4a+6e=100$
1×4	3	$4a+4e=80$
2−3	4	$2e=20$
4÷2	5	$e=10$
1&5	6	$a=10$

Data	1	$a+e+c=100$
	2	$4a+6e+12c=800=100\times 8$
1−c	3	$a+e=100-c$
2−12c	4	$4a+6e=800-12c$
3×4	5	$4a+4e=400-4c$
4−5	6	$2e=400-8c$ hence $c=\frac{400}{8}=50$
3×6	7	$6a+6e=600-6c$
7−4	8	$2a=6c-200$ hence $c=\frac{200}{6}=33\frac{1}{3}$
1−a	9	$e+c=100-a$
2−4a	10	$6e+12c=800-4a$
9×12	11	$12e+12c=1200-12a$
11−10	12	$6e=400-8a$ hence $a=\frac{400}{8}=50$
		And by the data a, may equal the left quantity

Data {	1	$a+e+u+y+z=80$
	2	$9a+6e+4u+3y+2z=400=80\times5$
1−a	3	$e+u+y+z=80-a$
2−9a	4	$6e+4u+3y+2z=400-9a$
3×2	5	$2e+2u+2y+2z=160-2a$
4−5	6	$4e+2u+y=240-7a$ hence $a \sqsupset \frac{240}{7}=34\frac{2}{7}$
if $a=34$	then	$9a=306$: & $80-34=46$: & $400-306=94$
then	7	$e+u+y+z=46$
	8	$6e+4u+3y+2z=94=46\times2\frac{1}{23}$
7−z	9	$e+u+y=46-z$
8−2z	10	$6e+4u+3y=94-2z$
9×3	11	$3e+3u+3y=138-3z$
10−11	12	$3e+u=12z-44$ hence $z \sqsubset 44$
3×6	13	$6e+6u+6y=276-6z$
13−10	14	$2u+3y=182-4z$ hence $z \sqsupset 45\frac{1}{2}$
if $z=45$,	then	$2z=90$, & $94-90=4$, & $46-45=1$,
then	15	$e+y+u=1$
	16	$6e+4u+3y=4=1\times4$
15−y	17	$e+u=1-y$
16−3y	18	$6e+4u=4-3y$
17×6	19	$6e+6u=6-6y$
19−18	20	$2u=2-3y$ hence $y \sqsupset \frac{2}{3}$
3×4	21	$4e+4u=4-4y$
18−21	22	$2e=y-0$

by the data in the first & 2d steps, any one of the unknown quantitys in the first may equal the left number, for if any one of them be taken quite away, the equation will not be absurd, because by the 2d step there are several values on each side the mean value.

If 20 fowls are to be Sold for 20 S. Cocks for 2 S, hens for one S. and Chickings for 4 pence a piece. how many Cocks & hens and Chickings are there?

Let $\begin{cases} a = \text{the number of Cocks.} \\ e = \text{the Chickings.} \\ u = \text{the hens.} \end{cases}$

Data	1	$a+e+u=20$
	2.	$24a+12u+4e=240=20\times12$
$1-e$	3	$a+u=20-e$
$2-4e$	4	$24a+12u=240-4e$
3×12	5	$12a+12u=240-12e$
$4-5$	6	$12a=8e$ hence $a:e::8:12$

and a, must be lefs than 8 because $8+12=20$ and leave none for u,

But a, may be any number under 8 So that when e, is in proportion to it as 12: to 8, the Sum of them may be lefs than 20:

hence $a=\begin{cases} 6.\ \&\ e=9.\ \&\ u=05 \\ 4.\ \&\ e=6.\ \&\ u=10 \\ 2.\ \&\ e=3.\ \&\ u=15 \end{cases}$

To find a number which divided by 19 leaves 17, but divided by 28 leaves 21.

To find this tis neceffary to find two numbers, one of which will divide exactly by 28, but being divided by 19, leaves 17, and the other will divide exactly by 19 but being divided by 28 leaves 21 & it is plain the Sum of thefe two numbers will be the number Sought.

Let the first number $= 28x$ for it is a multiple of 28, & because this number divided by 19 leaves 17, $\frac{28x-17}{19}$ is an integer, now 19 divides $19x$, ergo it will divide y^e remain i.e. $\frac{9x-17}{19} = n =$ is an integer also now $19n = 9x - 17$ & $x = \frac{19n+17}{9} =$ to an integer, because x is an integer, now 9 divides $18n+9$, ergo, it will divide the remain i.e. $\frac{n+8}{9}$ is an integer; Let it $= 1$, then is $n = 1$, & $x = 4$, & $28x = 112 =$ to the first number required.

Let the 2^d. number $= 19x$ for it is a multiple of 19, & because when divided by 28 it leaves 21, $\frac{19x-21}{28}$ is an integer

	1	$\frac{19x-21}{28}$ is integer or let it $= n$
$1 - 1 \times \overline{28}$	2	$19x - 21 = 28n$
$2 + 21$	3	$19x = 28n + 21$
$3 \div 19$	4	$x = \frac{28n+21}{19} =$ to an integer
ergo	5	$\frac{9n+2}{19} =$ to an integer; let it $= p$
$5 \times \overline{19}$	6	$9n + 2 = 19p$
$6 - \overline{2}$	7	$9n = 19p - 2$
$7 \div 9$	8	$n = \frac{19p-2}{9}$
ergo	9	$\frac{p-2}{9} =$ to an integer; or 0, let it $= 0$
then by 9	10	$p = 2$
& by 8	11	$n = 4$
& by 3	12	$19x = 133 =$ to the other number.
		now $112 + 133 = 245$ the number required.

To find a number which divided by 19 leaves 7. but divided by 13 leaves 12.

$\frac{19x-12}{13}$ = an integer

$\frac{6x-12}{13} = n$ & $x = \frac{13n+12}{6}$

& $\frac{n}{6} = 0$ or = an integer. let it = 0

then $19x = 38$ $\frac{13y-7}{19}$ is an integ.

& let $\frac{13y-7}{19} = n$, then $\frac{19n+7}{13} = y$

& $\frac{6n+7}{13} = p$ = an integ. then $n = \frac{13p-7}{6}$

& $\frac{p-1}{6} = 0$, or an integ. let it = 0

then $13y = 26$, & $13y+19x = 64$;

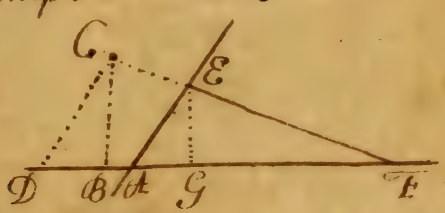
now $\frac{64}{19}$ leaves 7, & $\frac{64}{13}$ leaves 12.

One buys 40 bushels of wheat, & 24 bushels of barley, & 20 bushels of Oats all together for 15 pounds 12 Shillings. And again of the like grain, 26 bushels of wheat, 30 of barley, & 50 of Oats together for 16 pounds. And again. of the like grain, 24 bushels of wheat, 120 of barley, & 100 of oats for 34 pounds. How much did he give per, bushel for each sort of grain.

Let $\left\{\begin{matrix} x \\ y \\ z. \end{matrix}\right\}$ be the price of a bushel of $\left\{\begin{matrix} \text{wheat.} \\ \text{barley.} \\ \text{oats.} \end{matrix}\right.$

		L. S.
then	1	$40x+24y+20z = 15\text{ ll }12$
	2	$26x+30y+50z = 16\text{ ll }00$
	3	$24x+120y+100z = 34\text{ ll }00$
2 × 2	4	$52x+60y+100z = 32$
3 − 4	5	$60y-28x = 2$
5 ÷ 2	6	$30y-14x = 1$
1 × 5	7	$200x+120y+100z = 78$ L.
7 − 3	8	$176x = 44$
8 ÷ 176	9	$x = \frac{44}{176} = \frac{1}{4} = 5$ Shillings
6 & 9	10	$30y-\frac{14}{4} = 1$
10 + 14/4	11	$30y = \frac{18}{4}$
11 ÷ 2	12	$15y = \frac{9}{4}$
12 ÷ 3	13	$5y = \frac{3}{4}$
13 ÷ 5	14	$y = \frac{3}{20} = 3$ Shillings
		$z = 2$ Shillings.

A Dato puncto C rectam lineam CF ducere qua cum aliis duabus positione datis rectis AE & AF triangulum data magnitudinis AEF comprehendet.



Age CD parallelam AE, & CB ac EG perpendiculares AF, Sitque $AD = a$, $CB = b$ $AF = x$, & trianguli AEF area $= cc$,

	1	DF. AF (:: DC. AE) :: CB. EG, hoc est
	2	$a+x : x :: b : \frac{bx}{a+x} = EG.$
$\frac{bx}{a+x} \times \frac{x}{2}$	3	$\frac{bxx}{2a+2x} = cc =$ area AEF
&	4	$xx = \frac{2ccx+2cca}{b}$. & $x = \frac{cc+\sqrt{c^4+2ccab}}{b}$.

Methodus potestatum pararum radices inveniendi per Numerum. Edm. Halley. 1694.

$\sqrt{aa+b} = \sqrt{aa+b}$ vel $a + \frac{ab}{2aa-\frac{1}{2}b}$

$\sqrt[3]{aaa+b} = \frac{1}{2}a + \sqrt{\frac{1}{4}aa+\frac{b}{3a}}$ vel $a + \frac{ab}{3aaa+b}$

$\sqrt[4]{a^4+b} = \frac{2}{3}a + \sqrt{\frac{1}{9}aa+\frac{b}{6aa}}$ vel $a + \frac{ab}{4a^4-\frac{3}{2}b}$

$\sqrt[5]{a^5+b} = \frac{3}{4}a + \sqrt{\frac{1}{16}aa+\frac{b}{10a^3}}$ vel $a + \frac{ab}{5a^5+2b}$

$\sqrt[6]{a^6+b} = \frac{4}{5}a + \sqrt{\frac{1}{25}aa+\frac{b}{15a^4}}$ vel $a + \frac{ab}{6a^6+\frac{5}{2}b}$

$\sqrt[7]{a^7+b} = \frac{5}{6}a + \sqrt{\frac{1}{36}aa+\frac{b}{21a^5}}$ vel $a + \frac{ab}{7a^7+3b}$

Datis et mistura et mistorum gravitatibus Specificis, invenire proportionem mistorum inter Se.

Sit e gravitas Specifica mistura $A+B$ cujus A gravitas Specifica est a, & B gravitas b: et cum gravitas absoluta Seu pondus componatur ex mole corporis et gravitate Specifica, erit at pondus ipsius A, bB pondus ipsius B, & $eA+eB$ pondus aggregati $A+B$, adeoque $at+bB = eA+eB$, indeque $at+et = eB-bB$ Seu $e-b : a-e :: A : B$. Q. E. I.

Datis Sphæricorum Corporum in eadem rectâ moventium, sibique occurrentium magnitudinibus & motibus determinare motus eorundem post

post reflectionem.

Hujus resolutio ex his dependet conditionibus, ut corpus utrumque tantum reactione patiatur quantum agit in alterum, & ut eadem celeritate post reflectionem recedant ab invicem qua ante accedebant: his positis sint corporum A & B celeritates a, & b, respective; & motus (siquidem componatur ex mole & celeritate corporum) erunt aA & bB. & si corpora ad easdem plagas tendant, & A celerius movens insequatur B, pone x decrementum motus aA, & incrementum motus bB, percussione exortum: & post reflexionem motus erunt $aA-x$ & $bB+x$; & celeritates $\frac{aA-x}{A}$ ac $\frac{bB+x}{B}$ quarum differentia aequatur $a-b$ differentiae celeritatum ante reflextionem. Habetur itaq; aequatio $\frac{bB+x}{B} - \frac{aA+x}{A} = a-b$, & inde per reductionem fit $x = \frac{2aAB-2bAB}{AB}$ quo pro x in celeritatibus $\frac{aA-x}{A}$ & $\frac{bB+x}{B}$ substituto prodeunt $\frac{aA-aB+2bB}{A+B}$ celeritas ipsius A, & $\frac{2aA-bA+bB}{A+B}$ celeritas ipsius B post reflexionem. Quod si corpora obviam

eant

eant, tum Signo ipsius b ubique mutato, celeritates post reflexionem erunt $\frac{aA-aB-2bB}{A+B}$ & $\frac{2aA+bA-bB}{A+B}$: quarum alterutra Si forte negativa obvenerit, id arguit motum illum post reflexionem ad plagam dirigi ei contrariam ad quam A tendebat ante reflexionem. Id quod etiam de motu ipsius A in casu priori intelligendum est.

In a right angled triangle having the Sum of the Sides given, & the ratio between the two legs; to find each of them.

let the given Sum be

$= a = x+y+z$

& $x = by$

$\therefore x^2 = b^2y^2 = z^2 - y^2$

$b^2y^2 + y^2 = \overline{b^2+1} \times y^2 = z^2$

$y\sqrt{b^2+1} = z$ & $by + y = x + y$ $y = \frac{a}{\sqrt{b^2+1}+b+1}$

$y\sqrt{b^2+1} + b + 1 \times y = z + x + y = a$

Or if we make it, $by = z$ and $z+y+x = a$. then $x^2 = b^2y^2 - y^2$

$y\sqrt{b^2-1} + b + 1 \times y = z + y + x = a$

and $y = \frac{a}{\sqrt{b^2-1}+b+1}$

In a right angled triangle having the sum of the hypothenuse & one leg given to find the other leg.

$x+y=b$

$y^2-x^2=a^2$ by 47. 1. Euc.

$y=b-x$

$y^2=b^2-2bx+x^2=x^2=a^2$

$b^2-2bx=a^2$

$2bx=b^2-a^2$

$x=\frac{b^2-a^2}{2b}$ Or $x=\frac{b-\frac{a^2}{b}}{2}$ or $y-x=\frac{a^2}{b}$

Having the hypothenuse given & the sum of the two legs; to find each of them

$x+y=b$

$a^2-x^2=y^2$

$x^2=a^2-y^2$

$y=b-x$

$y^2=b^2-2bx+x^2$

$a^2-x^2=b^2-2bx+x^2$

$a^2=b^2-2bx+2x^2$

$2bx-2x^2=b^2-a^2$

$bx-x^2=\frac{b^2-a^2}{2}$ then by the 2d case in the Solution of Quadratick equations

$x=\frac{1}{2}b-\sqrt{\frac{1}{4}b^2-\frac{b^2-a^2}{2}}$.

or rather

$x=\sqrt{\frac{1}{4}b^2-\frac{b^2-a^2}{2}}+\frac{1}{2}b$.

If I sell an horse for 50 l. and get as much per cent. as he cost me. What does he cost me?

Let $50x$ = What he cost.

Then $\frac{50-50x}{50x} = \frac{50x}{100}$ & $\frac{1-x}{x} = \frac{x}{2}$

And $2-2x = x^2$ & $2x+x^2 = 2$ then by the first case in the Solution of Quadraticks $x = \sqrt{3}-1$

$50x = 50\sqrt{3}-1 = 36$ l. 12 s. 60. 3

If I sell an horse for 60 pounds & get as much per cent. as he cost me; What did he cost me?

Let x = what he cost.

Data		
	1	$x : 100 :: 60-x : x$
	2	$x^2 = 6000-100x$
	3	$x = \sqrt{8500}-50 = 92,195-50$
	4	$x = 92,195-50 =$ L. 42. S. 03. D. 10. q. 3.

To find two numbers whose product is twelve & the difference of their Squares 32

Data to		
	1	$xy = 12$
	2	$x^2-y^2 = 32$
$1 \div y$	3	$x = \frac{12}{y}$
3^2	4	$x^2 = \frac{144}{y^2}$
$2 \& 4$	5	$\frac{144}{y^2}-y^2 = 32$
$5 \times y^2$	6	$144-y^4 = 32y^2$
$6+y^4$	7	$144 = y^4+32y^2$

$y = \sqrt{\sqrt{400}-16} =$

Ex Arithmeticâ universali Newtoniana.

Reductio radicalium ad minimos terminos.

Radicalis, ubi totius radix extrahi nequit, plerumque concinnatur extrahendo radicem divisoris alicujus. - ic $\sqrt{aabc}$ extrahendo radicem divisoris a fit $a\sqrt{bc}$. Et $\sqrt{48}$ extrahendo radicem divisoris 16, fit $4\sqrt{3}$. Et $\sqrt{48aabc}$ extrahendo radicem divisoris $16aa$, fit $4a\sqrt{3bc}$. Et $\sqrt{\frac{a^3b}{cc} - \frac{4aabb}{cc} + \frac{4ab^3}{cc}}$, extrahendo radicem divisoris $\frac{a^2}{cc} - \frac{4ab}{cc} + \frac{4bb}{cc}$, fit $a - \frac{2b}{c}\sqrt{\frac{ab}{cc}}$. Hac reductio non tantum concinnandis radicalibus inservit, sed et earum additioni et subductioni, si modo ex parte radicali conveniant ubi ad primam simplicissimam reducuntur. Tunc enim unire possunt, quod aliter non fit. Sic $\sqrt{48} + \sqrt{75}$ per reductionem evadit $4\sqrt{3} + 5\sqrt{3}$ hoc est $9\sqrt{3}$.

Reductio Radicalium ad eandem denominationem.

Cum in radicalibus diversæ denominationis instituenda est multiplicatio vel divisio, oportet omnes ad eandem denominationem reducere, idque præfigendo Signum radicale cujus index est minimus numerus quem earum indices dividunt absq; residuo, et Suffixas quantitates totas ductas una vice in se ducendo quotie index ille jam major evaserit. Sic enim $\sqrt{}:aax$ evadit $\sqrt[6]{}:a^3x^3$ in $\sqrt[6]{}:a^4x^2$ hoc est $\sqrt[6]{}:a^2x^2$. Et $\sqrt{6}$ in $\sqrt[4]{}:\frac{5}{6}$ evadit $\sqrt{1:30}$ in $\sqrt[4]{}.\frac{5}{6}$ hoc est $\sqrt{1:30}$. Et $\frac{6aabb}{\sqrt{18ab^3}}$ fit $\frac{\sqrt{36a^2b}}{\sqrt{18ab^3}}$ sive $\sqrt{2.ab}$. & Sic in aliis.

Ex Wolfii Elementis matheseos.

Invenire duos numeros quorum summa æquatur quadrato minoris.

Sit numerus major $= x$, minor $= y$: erit $x+y=y^2$, tum $x=y^2-y=y-1\times y$, unde apparet numerum majorem esse factum ex minore in eundem minorem unitate auctatum.

Invenire duos numeros, ejus conditionis ut Summa quadratorum aequetur cubo minoris.

Sit major numerus x, minor $= y$:
erit $x^2+y^2 = y^3$, tum $x^2 = y^3 - y^2 = \overline{y-1} \times y^2$ et $x = y\sqrt{y-1}$. apparet adee, pro y assumendum esse numerum qui unitate quadratum excedit.

Invenire duos numeros, quorum quadrata differunt quadrato.

Sit numerus unus $= x+y$, alter $= x-y$:
erit per conditionem problematis

$x^2+2xy+y^2$
$x^2-2xy+y^2$
$4xy = v^2$ unde $x = \frac{v^2}{4y}$ patet

adee, pro y assumendum esse numerum per cujus quadruplum dividi potest quadratum aliquod.

Invenire duos numeros quadratos, qui differunt dato numero.

Sit latus quadrati minoris $= x$, majoris $= x+y$, differentia quadratorum $= d$: erit

$x^2+2xy+y^2-x^2 = 2xy+y^2 = d$, $2xy = d-y^2$
et $x = \frac{d-y^2}{2y}$ unde apparet, pro y assumi debere numerum, qui sit minor quam $\sqrt{d}$. Sit $d = 48$, $y = 4$: erit $x = \frac{48-16}{8} = 4$ et $x+y = 8$

Datum numerum dividere in duos numeros, quorum differentia est numerus quadratus.

Sit numerus datus = a, quaesitorum major = x, minor = y: erit per conditiones problematis $x+y=a$, & $x-y=v^2$ $x=a-y$, & $x=v^2+y$, & $a=v^2+2y$, ~~$xy=v^2$~~ & $2y=a-v^2$, & $y=\frac{a-v^2}{2}$. pro vv^2 itaque assumendus numerus quadratus, qui ex numero dato a, subductus, parem relinquit.

Summam duorum quadratorum in duo alia quadrata dividere.

Sit latus quadrati majoris = a, minoris = b. Sit porro latus quadrati unius ex quaesitis minus quam a, adeoque $a-z$; erit quadrati alterius latus majus quam b. poterat itaque dici $y-b$. Enimvero ut in calculo irrationalitas evitetur, rectius id nuncupatur $yz-b$. quare per conditionem problem.

$a^2-2az+z^2+y^2z^2-2byz+b^2=a^2+b^2$. ergo $z^2+y^2z^2-2az-2byz=0$, & $z+yz-2a-2by=0$, inde $z+y^2z=2a+2by$, & $z=\frac{2a+2by}{y^2+1}$.

Two Children are of such ages, that if the age of the Least be subtracted from the square of the youngest's age there will remain ten years; and if the age of the youngest be subtracted from the square of the eldest age there will remain thirty two; and the product of their ages is 24. How many years old is each?

Data
1 $a^2 - e = b = 10$
2 $e^2 - a = c = 32$
3 $ae = d = 24$

1+e 4 $a^2 = b + e$
3:a 5 $e = \frac{d}{a}$
3:a 6 $e^2 = \frac{d^2}{a^2} = b + c$
6+e² 7 $d^2 = b^2 + c^2$
2+a 8 $e^2 = c + a$
3:a 9 $e = \frac{d}{a}$
4+9 10 $e^2 = a^2 + \frac{d^2}{a^2}$
8×b 11 $be^2 = bc + ba$
10+11 12 $be^2 + e^2 = bc + ba + a^2 + \frac{d^2}{a^2}$
12×a 13 $ba^2 + be^2 + e^2 = bca + ba^2 + a^3 + d^2$
13−4c 14 $2ba^2 - bca - ca^2 - ba^3 = d^2$
4² 15 $a^4 - 2ba^2 + b^2 - 2ca^2 + bca + c^2 = d^2$
5:b 16 $a^4 - 2ba^2 - 2ca^2 + bca + b^2 + c^2 = \frac{d^2}{b}$
make 17 $2,2.a - a^2 = 7,6$ and by the
in the Solution of quadratic
18 $a = 11,6 - \sqrt{7,76} = 11,6 - 7,6 = 4.$
9+16 19 $c = 6.$

or thus Data eadem manentia

4 $e = a^2 - b$
5 $e = \frac{d}{a}$
6 $e^2 = c + a$
4×5 7 $e^2 = \frac{da^2 - db}{a^2}$
6&7 8 $\frac{da^2 - db}{a^2} = c + a$ hence
$a = \sqrt{\frac{c^2}{2d-1} + \frac{db}{d-1}} + \frac{c}{2d-2}$

or $a = \sqrt{\frac{b^2}{4c^2} + \frac{d^2 d}{c}} + \frac{b}{2c}$

Theorem for alternations and combinations of things.

Let m = the number of things different each from other.

Then, the Number of the Alternations of m things a, b, c, d, &c. different each from other, taken n & n (i.e.) the number in each Alternation being n,

is = to $m \times m-1 \times m-2 \times m-3 \times$ &c. continued to n places.

The number of the Combination of m things a, b, c, d, &c. different each from other, taken n & n,

is = to $\frac{m \times m-1 \times m-2 \times m-3 \times}{n \times n-1 \times n-2 \times n-3 \times}$ &c. each Series continued to n places.

The number of the Alternations of m things a, b, c, d, &c. different each from other taken n & n

is = to $m \times m-1 \times m-2 \times m-3 \times$ &c. continued to n places.

To divide any given number into 3 numbers continually proportional, So that that the sum of the Squares of the extreams may be triple the Square of the mean.

Data	1	$x+y+z=a$
	2	$x:y::y:z$
	3	$3y^2=x^2+z^2$
$-y$	4	$x+z=a-y$
4^{to}	5	$x^2+z^2+2xz=a^2-2ay+y^2$
$2\times$	6	$xz=y^2$
6×2	7	$2xz=2y^2$
$5-7$	8	$x^2+z^2=a^2-2ay-y^2$
$3=8$	9	$3y^2=a^2-2ay-y^2$
$+y^2$	10	$4y^2=a^2-2ay$
$+2ay$	11	$4y^2+2ay=a^2$
$:4$	12	$y^2+\frac{1}{2}ay=\frac{a^2}{4}$
	13	$y^2=\sqrt{\frac{5a^2}{16}}-\frac{a}{4}$. by the first case in the Solution of Quæst. or. $y=\frac{a}{4}\sqrt{5}-\frac{a}{4}$

To find two numbers whose Sum is 6 and the difference of their Cubes 56.

Data	1	$x^3 - y^3 = 56$
	2	$x + y = 6$
Let	3	$x - y = r$
3 @ 3	4	$x^3 - 3x^2y + 3xy^2 - y^3 = r^3$
1 − 4	5	$3x^2y - 3xy^2 = 56 - r^3$
5 ÷ 3x − 3y	6	$\frac{3x^2y - 3xy^2}{3x - 3y} = \frac{56 - r^3}{3r} = xy$
6	7	$xy = \frac{56}{3r} - \frac{r^2}{3}$
2 − y	8	$x = 6 - y$
8 × y	9	$xy = 6y - y^2$
7 = 9	10	$6y - y^2 = \frac{56}{3r} - \frac{r^2}{3}$
	11	$y = 3 - \sqrt{9 + \frac{r^2}{3} - \frac{56}{3r}}$ $x = 3 + \sqrt{9 + \frac{r^2}{3} - \frac{56}{3r}}$ } by the third case in the Solution of quadratics.

Now if r be taken any number whatever it will answer the question, only perhaps x or y may one of them be a negative quantity. or the quantity $9 + \frac{r^2}{3} - \frac{56}{3r}$ may prove negative and so the Square root of it impossible or unintelligible.

If a Binomial be to be raised to any power ex. g. m, which represents any number, whole or broken, positive or negative; then the Uncia or numbers prefix'd to the Severall terms are,

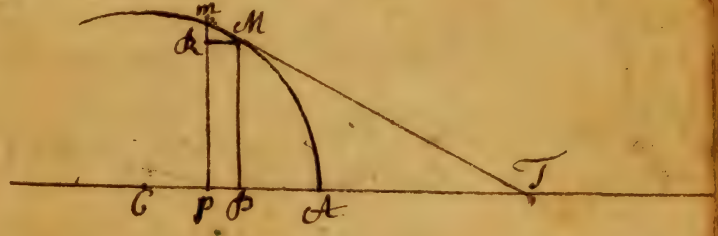
$1 \times \frac{m-0}{1} \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4}$ &c. respectively.

And if $P+PQ$ represent the quantity to be raised to the given power; P the first term, and Q the rest divided by that first term; & $\frac{m}{n}$ the exponent of that root or dimention, then $\overline{P+PQ}|^{\frac{m}{n}} = \overset{A}{P^{\frac{m}{n}}} + \frac{m}{n} \overset{B}{AQ} + \frac{m-n}{2n} \overset{C}{BQ} + \frac{m-2n}{3n} CQ$ &c.

For instance $\overline{rr-xx}^{\frac{1}{2}}$ in which $P=rr$ & $Q=\frac{-x^2}{rr}$ is $= r - \frac{x^2}{2r} - \frac{x^4}{8r^3} - \frac{x^6}{16r^5} - \frac{x^8}{128r^7}$ &c.

and $\overline{a+x}^m$ in which $P=a$ & $Q=\frac{x}{a}$ and $\frac{m}{n}=m$ (n in this case being $=1$) is $= a^m + ma^{m-1}x + m \times \frac{m-1}{2} \times a^{m-2}x^2$ $+ m \times \frac{m-1}{2} \times \frac{m-2}{3} a^{m-3}x^3 + m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} a^{m-4}x^4$ &c.

To find the Subtangent of any Algebraic Curve.



$Rm : MR :: PM : PT$

$\dot{y} : \dot{x} :: y : \frac{y\dot{x}}{\dot{y}}$

The Equation defining a circle is,

$ax - xx = yy$ hence $a\dot{x} - 2x\dot{x} = 2y\dot{y}$ & $\dot{x} = \frac{2y\dot{y}}{a-2x}$

And $PT = \frac{y\dot{x}}{\dot{y}} = \frac{2y^2}{a-2x} = \frac{2ax-2x^2}{a-2x} = \frac{ax-x^2}{\frac{a}{2}-x}$

ergo $AT = \frac{ax-x^2}{\frac{1}{2}a-x} + x = \frac{ax-x^2+\frac{1}{2}ax-x^2}{\frac{1}{2}a-x} =$

$= \frac{\frac{1}{2}ax}{\frac{1}{2}a-x}$. $= \frac{\frac{3}{2}ax-2x^2}{\frac{1}{2}a-x} = \frac{\frac{1}{2}ax}{\frac{1}{2}a-x}$

For the parabola.

$ax = y^2$ hence $a\dot{x} = 2y\dot{y}$ & $x = \frac{2y\dot{y}}{a}$

And $PT = \frac{y\dot{x}}{\dot{y}} = \frac{2y^2\dot{y}}{a\dot{y}} = \frac{2y^2}{a} = \frac{2ax}{a} = 2x$.

To find the Curve whose Subtangent is $= \frac{2y^2}{a}$. now $\frac{y\dot{x}}{\dot{y}} = \frac{2y^2}{a}$ & $ay\dot{x} = 2y^2\dot{y}$ & $a\dot{x} = 2y\dot{y}$ ergo $ax = y^2$ a Parabola.

To find the Curve whose Subtangent is a third proportional to $r-x$ & y.

now $r-x : y :: y : \frac{y\dot{x}}{\dot{y}}$ whence $\frac{ry\dot{x}-yx\dot{x}}{\dot{y}} = y^2$ & $ry\dot{x} - yx\dot{x} = y^2\dot{y}$ & $r\dot{x} - x\dot{x} = y\dot{y}$ ergo $rx - \frac{1}{2}xx = \frac{1}{2}y^2$ & $2rx - x^2 = y^2$ a Circle.

To find the line whose Subtangent is equal to its Semiordinate

$\frac{y\dot{x}}{\dot{y}} = y$ $y\dot{x} = y\dot{y}$ $\dot{x} = \dot{y}$ $x = y$

a triangle with equal Legs.

Ut ad Quadraturas curvarum deveniamus, primò, assumatur valor ordinatim applicatæ, ope æquationis naturam curvæ exprimentis; 2^do multiplicetur hic valor per Fluxionem abscissæ; rectangulum hinc ortum erit Fluxio areæ. 3^tio, Data Fluxione areæ, reperiatur quantitas fluens, habebitur area quæsita.

Ponatur æquatio $x^n = y^m$ cujusvis Parabolöidos naturam exprimens; valor ordinatim applicatæ $y = x^{\frac{n}{m}}$ qui si multiplicetur per $\dot{x}$, rectangulum $x^{\frac{n}{m}}\dot{x}$ erit Fluxio areæ, proindeque area quæsita erit $\frac{n}{m+n}x^{\frac{m}{n}+1}$, seu (posito y pro $x^{\frac{m}{n}}$) erit $\frac{n}{m+n}xy$.

Rursum proponatur curva cujus æquatio sit $x^4 + a^2x^2 = y^2$, assumpto $x\sqrt{x^2+a^2} = y$, fluxio areæ erit $\dot{x}x\sqrt{x^2+a^2}$: cum autem sub radicalitate involvatur, supponatur $\sqrt{x^2+a^2} = z$, hinc $x^2+a^2 = z^2$, ideoque $x\dot{x} = z\dot{z}$, positisque $z\dot{z}$ & z pro $x\dot{x}$ & $\sqrt{x^2+a^2}$, fluxio a surdis liberata erit $z^2\dot{z}$, quam si ad originem suam $\frac{1}{3}z^3$ revocaverimus, repositoque $\sqrt{x^2+a^2}$ pro z, habebitur $\frac{1}{3}x^2+a^2\sqrt{x^2+a^2}$ pro area quæsita.

Rursum sit æquatio curvæ $\frac{x^2}{x+a} = y^2$; igitur $y = \frac{x}{\sqrt{x+a}}$, ideoque $\frac{x\dot{x}}{\sqrt{x+a}}$ est Fluxio areæ: Supponatur $\sqrt{x+a} = z$ hinc $x+a = z^2$, & $x = zz\dot{z}$, itaque $\frac{x\dot{x}}{x+a} = 2z^2\dot{z} - 2a\dot{z}$, ac proinde $\frac{2}{3}z^3 - 2ax$; vel $\frac{2}{3}x - \frac{4}{3}a\sqrt{x+a}$ erit area quæsita.

Parabolam rectificare.

$ax = y^2$ & $a\dot{x} = 2y\dot{y}$ & $a^2\dot{x}^2 = 4y^2\dot{y}^2$ &
$\dot{x}^2 = \frac{4y^2\dot{y}^2}{a^2}$, & $\sqrt{\dot{x}^2+\dot{y}^2} = \sqrt{\dot{y}^2 + \frac{4y^2\dot{y}^2}{a^2}} =$
$= \dot{y}\sqrt{\frac{a^2+4y^2}{a^2}} = \frac{\dot{y}\sqrt{a^2+4y^2}}{a}$. Ut hoc Elementum Curvae integrabile fiat; resolvatur in seriem infinitam.

tum $\frac{\dot{y}\sqrt{a^2+4y^2}}{a} = \dot{y} + \frac{2y^2\dot{y}}{a^2} - \frac{2y^4\dot{y}}{a^4} + \frac{4y^6\dot{y}}{a^6} - \frac{10y^8\dot{y}}{a^8}$

Cujus integrale $y + \frac{2y^3}{3a^2} - \frac{2y^5}{5a^4} + \frac{4y^7}{7a^6} - \frac{10y^9}{9a^8}$, &c. in infinitum, exprimit arcum parabolicum.

Rectificare parabolam secundi generis, ad quam $ax^2 = y^3$, seu sumpto $a=1$, $x^2 = y^3$ & $2x\dot{x} = 3y^2\dot{y}$, & $\sqrt{\dot{x}^2+\dot{y}^2} = \sqrt{\,}$ & $4x^2\dot{x}^2 = 9y^4\dot{y}^2$, &
$\dot{x}^2 = \frac{9y^4\dot{y}^2}{4x^2} = \frac{9y^4\dot{y}^2}{4y^3} = \frac{9y\dot{y}^2}{4}$.

et $\sqrt{\dot{x}^2+\dot{y}^2} = \sqrt{\frac{9}{4}y\dot{y}^2 + \dot{y}^2} = \frac{1}{2}\sqrt{9y\dot{y}^2 + 4\dot{y}^2} =$
$= \frac{1}{2}\dot{y}\sqrt{9y+4}$. ut Elementum integrabile reddatur, fiat $\sqrt{9y+4} = v$, et erit $9y+4 = v^2$, & $9\dot{y} = 2v\dot{v}$, & $\frac{1}{2}\dot{y}\sqrt{9y+4} = \frac{1}{9}v^2\dot{v}$. $\int \frac{1}{2}\dot{y}\sqrt{9y+4} = \frac{1}{27}$
$= \frac{1}{27}\sqrt{9y+4} \times \sqrt{9y+4}$. ut vero Summa exprimat longitudinem arcus; fiat $y=0$; erit residuum $= \frac{4}{27}\sqrt{4} = \frac{8}{27}$: adeoq; arcus $= \frac{1}{27}\sqrt{9y+4} \times \sqrt{9y+4} - \frac{8}{27}$.

In circulo, dato Sinu invenire arcum.

Sit radius $=1$, & erit $2x - x^2 = y^2$ ergo $2\dot{x} - 2x\dot{x} = 2y\dot{y}$, & $\dot{x} = \frac{y\dot{y}}{1-x}$ & $\dot{x}^2 = \frac{y^2\dot{y}^2}{1-2x+x^2}$

$\&\ \frac{\dot{y}\dot{y}^2}{1-2x+x^2} = \frac{y^2\dot{y}^2}{1-y^2}\ \&\ \sqrt{\dot{x}^2+\dot{y}^2} = \sqrt{\frac{y^2\dot{y}^2}{1-y^2}+\dot{y}^2} =$

$= \sqrt{\frac{\dot{y}^2y^2+\dot{y}^2-y^2\dot{y}}{1-y^2}} = \frac{\dot{y}}{1-y^2}\Big]^{-\frac{1}{2}}$. resolvatur hoc elementum in Seriem infinitam per extractionem radicis,

est adeo $\dot{y}\sqrt{\frac{1}{1-y^2}} = \dot{y} + \frac{y^2\dot{y}}{2} + \frac{3y^4\dot{y}}{2.4} + \frac{3.5y^6\dot{y}}{2.4.6.} \&c$

in infinitum; cujus integrale

$y + \frac{y^3}{1.3} + \frac{3y^5}{2.4.5.} + \frac{3.5.y^7}{2.4.6.7} + \frac{3.5.7y^9}{2.4.6.8.9}$ &c. est arcus cujus Sinus est y, Siny toto existente 1.

Si terminus primus dicatur A, Secundus B, tertius C, &c. & Secundus multiplicetur per $\frac{1}{1}$, tertius per $\frac{3}{3}$, quartus per $\frac{5}{5}$, &c. Series inventa in hanc degenerat: $y + \frac{1.1Ay^2}{2.3} + \frac{3.3By^2}{4.5} + \frac{5.5Cy^2}{6.7}$

Dato arcu invenire Sinum.

Sit radius = 1, & arcus = v;

erit $v = y + \frac{1}{6}y^3 + \frac{3}{40}y^5$ &c. in infinitum (per pra) valor ipsius y invenitur extrahendo radicem ex $y + \frac{1}{6}y^3 + \frac{3}{40}y^5$ &c. est etiam radix

$y = \frac{v}{1} - \frac{v^3}{1.2.3} + \frac{v^5}{1.2.3.4.5.} - \frac{v^7}{1.2.3.4.5.6.7}$ &c. in infi= =nitum

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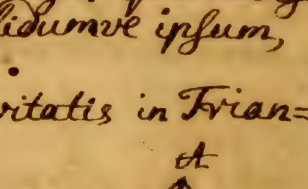
Ad dimetiendam Superficiem conversione curvæ, circa axem Suum descriptam, assumi debet pro ejus fluxione Cylindrica, Superfi= cies cujus altitudo est ipsa curvæ fluxio, cujusque distantia ab axe est ordinatim applicata, huic fluxioni conveniens.

Sit ex. gr. (figu. in pagina 39^na) AM circuli arcus qui circa axem AP revolvendo, Superficiem Sphæricam generet, quamque dimetiri Statuamus; Mm arcus fluxio jam reperta est $\frac{r\dot{x}}{\sqrt{2rx-x^2}}$, hanc Si multi=plicemus per circumferentiam ad radium PM pertinentem; hoc est $\frac{c}{r}\frac{r\dot{x}}{\sqrt{2rx-x^2}}$ (posita ratione circumferentiæ ad radium $=\frac{c}{r}$) habe=bimus fluxionem Superficiei Sphæricæ $=c\dot{x}$ adeoque Superficies ipsa est cx.

Ad Centra Gravitatis quod attinet reperi=tâ Superficiei Solidive fluxione, hacque ducta in Suam a vertice distantiam, ad quantita=tem fluentem recurrendum est: qua divisa per Superficiem ipsam Solidumve ipsum, prodibit distatia a vertice.

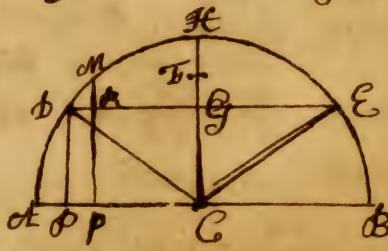
Determinare Centrum gravitatis in Trian=gulo ABC



Ducatur recta AD, basin BC bifariam Secans in D.
Quoniam $\triangle BAD=\triangle DAC$, utrumque in totidem pun=ctuscula ad communem axem AD eodem modo utrinque applicata resolvi potest; adeoque Centrum gravitatis $\triangle BAC$ erit in AD. Illud igitur ut determinetur, fiat $AD=a$ $BC=b$, $AP=x$, $MN=y$; erit $x:y::a:b$, hinc $y=\frac{bx}{a}$ Ducatur $AE=c$ perpendicularis ad BC, erit $AD:AE::AP:A2$, adeoque $A2=\frac{c\dot{x}}{a}$, & $2q=\frac{c\dot{x}}{a}$ unde momentum $yx\dot{x}=\frac{cbx^2\dot{x}}{a^2}$, & $\int yx\dot{x}=\frac{cbx^3}{3a^2}$ quæ Summa per aream trianguli AMN divisa (id est

(id est $\frac{cbx^3}{3a^2}$ per $\frac{cbx^2}{a^2}$ divisa) dat distantiam $\frac{4}{5}$ centri gravitatis a vertice $= \frac{2abx^3}{3abx^2} = \frac{2}{3}x$. quod si pro x substituatur a; prodibit, in linea AD, distantia centri gravitatis a vertice $= \frac{2}{3}a$ Q. E. I.

Determinare Centrum gravitatis cujuslibet arcûs circuli.



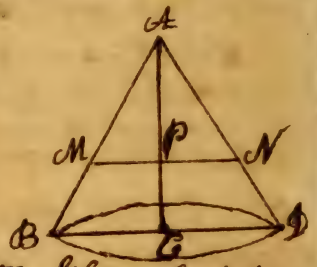
Sit Chorda DE arcus dati DHE, diameter AB parallela; quæ instar axis considerentur, ad quem pondus-cula MD applicata, quorum adeo momenta erunt ut MD×PC. Quoniam adeo ad radium HC, qui arcum DE in G bisecat, pondusçula et numero et momento æqualia utringue disponuntur; transit is per centrum gravitatis. Sit jam, $PC = DG = x$, $PC = a$, erit $Dd = Pp = \dot{x}$, & ob Similitudinem triangulorum MDd & PDC, cum sit $MD : Dd = DC : PD = a\dot{x}$. Summa ergo momentorum $ax = DC \times DG$, quæ divisa per DH, centri gravitatis T distantiam a centro circuli C determinabitur.

Inveniendum sit centrum gravitatis omnium parabolidum; horum fluxio sic generaliter exprimitur $x^{\frac{m}{n}}\dot{x}$, hanc multiplica per x, fit $x^{\frac{m}{n}+1}\dot{x}$, cujus quantitatem fluentem $\frac{n}{m+2n}x^{\frac{m}{n}+2}$, divide per paraboloidos aream, puta $\frac{n}{m+2n}x^{\frac{m}{n}+1}$; prodibit $\frac{m+n}{m+2n}x$, distantia centri gravitatis a vertice.

Centrum

Centrum gravitatis in portione Sphæræ eodem modo colligitur; namque illius fluxione $4\frac{dx\dot{x}-x^2\dot{x}}{n}$ in x ducta fit $4\frac{dx^2\dot{x}-x^3\dot{x}}{n}$, cujus quantitas fluens $4\frac{\frac{1}{3}dx^2-\frac{1}{4}x^4}{n}$, per portionis Soliditatem divisa, puta $4\frac{\frac{1}{2}dxx-\frac{1}{3}x^3}{n}$, exhibet $\frac{\frac{1}{3}d-\frac{1}{4}x}{\frac{1}{2}d-\frac{1}{3}x}x$, seu $\frac{4d-3x}{6d-4x}x$, distantiam centri gravitatis a vertice.

Invenire Centrum gravitatis Coni et Pyramidis.



Sit $AC : BD :: AP : MN$
$a : p :: x : y$
hinc $y = \frac{px}{a}$ & $y^2 = \frac{p^2x^2}{a^2}$
Sit ratio quadrati ad circulum $= \frac{n}{1}$ tum erit fluxio portionis coni $\frac{p^2x^2\dot{x}}{na^2}$ quam multiplica per x distantiam a vertice, fit $\frac{p^2x^3\dot{x}}{na^2}$, cujus quantitas fluens $\frac{p^2x^4}{4a^2n}$, per portionis coni Soliditatem, puta $\frac{p^2x^3}{3na^2}$, divisa, exhibet $\frac{3}{4}x = \frac{3}{4}AP$. adeoque coni integri Centrum gravitatis distat a vertice $\frac{3}{4}AC$.
Eodem prorsus modo invenitur distantia Centri gravitatis a vertice in Pyramide $= \frac{3}{4}AC$. Q. E. I.

Methodus hæc, eadem facilitate ad dimensionem Solidorum a plani circumvolutione genitorum accommodatur; nempe assumendo pro eorum fluxione, productam ex fluxione abscissæ $\overset{per}{in}$ circulum basis; ratio quadrati ad circulum sibi inscriptum vocetur $\frac{n}{1}$, æquatio circulo competens est $y^2 = dx - x^2$, $4\frac{dx\dot{x} - x^2\dot{x}}{n}$ est fluxio portionis Sphæræ, igitur $4\frac{\frac{1}{2}dx^2 - \frac{1}{3}x^3}{n}$ est portio ipsa: huic circumscriptus cylindrus est $4\frac{dx^2 - x^3}{n}$, ideoque ratio portionis Sphæræ ad circumscriptum Cylindrum est ut $\frac{1}{2}d - \frac{1}{3}x$ ad $d - x$.

Determinare maximam vel minimam applicatam in curva Algebraica.

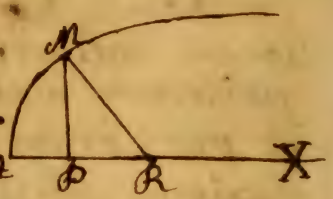
Ex æquatione curvæ quærendus est valor ipsius $\dot{y}$, & vel nihilo, vel infinito æquandus, ut habeatur valor abscissæ, cui maxima applicata coordinatur.

Quoniam in circulo $2rx - x^2 = y^2$ erit $2r\dot{x} - 2x\dot{x} = 2y\dot{y}$ & $\frac{2r\dot{x} - 2x\dot{x}}{2y} = \dot{y} = 0$ ergo $2r - 2x = 0$ & $2r = 2x$, & $r = x$, nempe maxima Semiordinata in circulo, erigitur ex centro.

Quodsi ponamus $\frac{2y\dot{y}}{2r - 2x} = \dot{x} = \infty$; erit $2r - 2x$ respectu numeratoris $2y\dot{y}$ infinite parva, adeoque $r = x$, ut ante.

A Dato

A Dato puncto R in axe AX curvæ algebraicæ ducere ad perimetrum curvæ rectam MR, quæ sit minima omnium ex eodem puncto R ducendarum.



Sit AP=x, PM=y, AR=c; erit PR=c−x, & (per Euc. 47. 1.) erit $c^2-2cx+x^2+y^2=z^2$, z=MR posito. tum $-2c\dot{x}+2x\dot{x}+2y\dot{y}=2z\dot{z}=0$, et inde $y\dot{y}+x\dot{x}-c\dot{x}=0$.

Quodsi ex æquatione ad curvam algebraicam datâ, pro yẏ substituatur valor ejus; valorem ipsius x eruere licet.

Corrollarium.

In parabola $ax=y^2$, et $\frac{1}{2}a\dot{x}=y\dot{y}$ ergo $\frac{1}{2}a\dot{x}+x\dot{x}-c\dot{x}=0$, & $\frac{1}{2}a+x=c$, & $\frac{1}{2}a=c-x$, hinc $ax=ac-\frac{1}{2}aa=y^2$, & $\overline{c-x}^2+y^2=\frac{1}{4}aa+ac-\frac{1}{2}aa=$ $=ac-\frac{1}{4}aa=z^2$, unde $MR=z=\sqrt{ac-\frac{1}{4}aa}$.

Lineam rectam AB ita secare in P, ut $AP^m \times PB^n$ sit maximum factorum simili modo formatorum. Sit AB=a, AP=x, erit BP=a−x, consequenter $AP^m \times PB^n = x^m\overline{a-x}^n$ erit igitur x abscissa respondens semiordinatæ maximæ in infinitis circulis, ad quos

$x^m\overline{a-x}^n=y^{m+n}$. & hinc

$mx^{m-1}\overline{a-x}^n\dot{x}-nx^m\overline{a-x}^{n-1}\dot{x}=0$ & inde

$mx^{m-1}\overline{a-x}^n=nx^m\overline{a-x}^{n-1}$, & $m\overline{a-x}=nx$ & $ma=nx+mx$, $\frac{ma}{m+n}=x$.

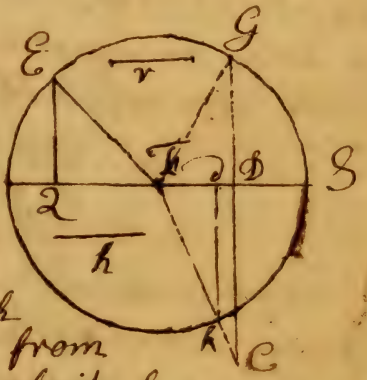
To find that fraction, the difference between whose Square & Cube, is greater than the difference of the Square & Cube of any other fraction.

let x = the fraction

then $x^2 - x^3$ = a maxima and $2x\dot{x} - 3x^2\dot{x} = 0$

ergo $2x\dot{x} = 3x^2\dot{x}$ & $2x = 3x^2$ & $2 = 3x$ & $x = \frac{2}{3}$. Q. E. I.

Let the two points E & C & the right line S S in the same plain with them be given; and let it be required to find the point F in the line S S so that a body moving from E to F, with the given velocity r, and from F to C, with the given velocity h, shall move from E by F to C in the shortest time.



Let F be the point required; and on the same as a centre with the radius FE, describe the circle S E G S k, and on S S let fall the perpendiculars E 2 & C D & k d. Then suppose the given quantities E 2 = a, 2 D = b, C D = c, & 2 F = x and then F D = $b - x$, & E F = $\sqrt{a^2 + x^2}$ and F C = $\sqrt{c^2 + b^2 - 2bx + x^2}$. Now it is manifest, that if a body move from E to F with the velocity r, and from F to C with the velocity h; if those velocities are equal, then the times will be as the spaces described E F & F C, and if the spaces E F & F C are equal, & the velocities unequal, the times will be reciprocally as the velocities;

ergo

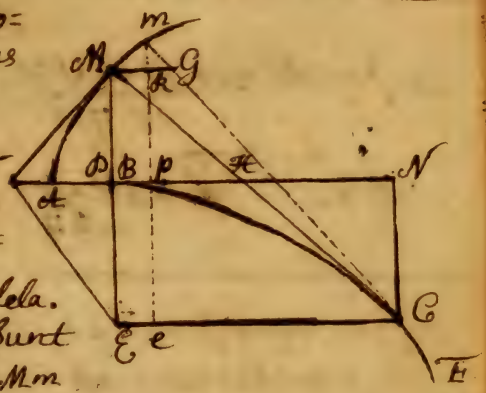
erge; if the Spaces & velocities are both unequal the times will be in a ratio compound=ed of the direct ratio of the Spaces, & the reci=procal ratio of the velocities: that is, the time which the body takes to move from E to F will be represented by $\frac{EF}{r}$, and that from F to C, by $\frac{FC}{h}$, and the Sum of both $\frac{EF}{r} + \frac{FC}{h}$ or $h \times EF + r \times FC$, will represent the Shortest time in which a body can move from E by F to C, with the respective velocities.

Now if we Suppose $EF = \sqrt{a^2+x^2} =$ (for brevities Sake) $= Vm$. And $FC = \sqrt{c^2+b^2-2bx+x^2} = Vn$, then we Shall have $hVm + rVn =$ to a minima; and re=ducing the Same to fluxions we have $\frac{-h\dot{m}}{2Vm} - \frac{r\dot{n}}{2Vn} = 0$. but $\dot{m} = 2x\dot{x}$, and $\dot{n} = 2x\dot{x} - 2b\dot{x}$, therefore $\frac{-h\dot{m}}{2Vm} - \frac{r\dot{n}}{2Vn} = 0$ is $= \frac{-2hx\dot{x}}{2Vm} - \frac{2rx\dot{x} + 2rb\dot{x}}{2Vn} = 0$. And by tranſpoſition & diviſion $\frac{rb-rx}{FC} = \frac{hx}{FE}$. whence it is an eaſy matter to find the value of x or $2F$. Q. E. I.

De curvarum Evolutis, et Radio Oſculi.

Determinare radium oſculi in curvis, quarum Semiordinatæ PM & pm Sunt ad axem perpendiculares

Sit Semiordinata pm alteri PM infinite propinqua; Sit item radius oſculi Cm alteri CM infinite propinquus. Ducatur CE ipſi AB paralela, donec Semiordinata MP continuata in E occurrat; & MG eidem axi AB paralela. Quoniam anguli EKR & KRC ſunt recti, et ob EMG & CMm rectos, EMC = GMm; erit



$$MK : Mm :: ME : MC$$
$$\dot{x} : \sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}} :: t : \frac{t\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}}{\dot{x}}$$

Jam cum radius MC conſtans intelligatur quamdiu ex centro C, arcus infinite parvus Mm deſcribitur, interea vero ME augeatur quantitate differentiali Em: erit radii oſculi CM differentiale nullum. Sed Si $\dot{x}$ ſumatur pro conſtante, differentiale ipſius MC eſt, $\frac{\dot{t}\dot{x}\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}}{\dot{x}\dot{x}} + \frac{t\dot{y}\dot{x}\dot{y}}{\dot{x}^2\sqrt{\dot{x}^2+\dot{y}^2}} = \frac{\dot{t}\dot{x}^2+\dot{t}\dot{y}^2+t\dot{y}\ddot{y}}{\dot{x}\sqrt{\dot{x}^2+\dot{y}^2}}$

ergo $\frac{\dot{t}\dot{x}^2+\dot{t}\dot{y}^2+t\dot{y}\ddot{y}}{\dot{x}\sqrt{\dot{x}^2+\dot{y}^2}} = 0$ & $\dot{t}\dot{x}^2+\dot{t}\dot{y}^2 = -t\dot{y}\ddot{y}$

Quoniam mK differentiale Semiordinatae etiam differentiale ipſius ME ob PE conſtantem; $\dot{t}=\dot{y}$. Quare $\dot{x}^2+\dot{y}^2 = -t\ddot{y}$ & $\frac{\dot{x}^2+\dot{y}^2}{-\ddot{y}} = t$.

Quodſi itaque ex aequatione ad curvam ſubſtituatur valor ipſius $\dot{y}^2$ & $-\ddot{y}$; prodibit ME = t in quantitatibus ordinariis.

Si vero radius evoluta ipſe MC deſideretur (quem interdum invenire praeſtat)

fiat ob PH = $\frac{y\dot{y}}{\dot{x}}$ MP : PH :: ME : EC

$$y : \frac{y\dot{y}}{\dot{x}} :: \frac{\dot{x}^2+\dot{y}^2}{-\ddot{y}} : \frac{\dot{x}^2\dot{y}+\dot{y}^3}{-\dot{x}\ddot{y}}$$

unde $EC^2 = \frac{\dot{x}^4\dot{y}^2+2\dot{x}^2\dot{y}^4+\dot{y}^6}{\dot{x}^2\ddot{y}^2}$ & etiam ME^2

et etiam $ME^2 = \frac{\dot{x}^4 + 2\dot{x}^2\dot{y}^2 + \dot{y}^4}{\ddot{y}^2} = \frac{\dot{x}^6 + 2\dot{x}^4\dot{y}^2 + \dot{x}^2\dot{y}^4}{\dot{x}^2\ddot{y}^2}$

$MC^2 = \frac{\dot{x}^6 + 3\dot{x}^4\dot{y}^2 + 3\dot{x}^2\dot{y}^4 + \dot{y}^6}{\dot{x}^2\ddot{y}^2} = \frac{\dot{x}^4 + 2\dot{x}^2\dot{y}^2 + \dot{y}^4 \times \dot{x}^2 + \dot{y}^2}{\dot{x}^2\ddot{y}^2}$

$MC = \frac{\dot{x}^2 + \dot{y}^2 \times \sqrt{\dot{x}^2 + \dot{y}^2}}{-\dot{x}\ddot{y}}$.

Data aequatione ad curvam algebraicam, invenire aequationem ad evolutam.

Investigentur quantitates BN & CN in valore abscissae AP aut semiordinatae PM. Minimum ME invenitur (per problema superius): unde subducta PM relinquit $PE = NC$. Sed per analogiam $PM : PH :: ME : EC$ reperitur EC. Si vero ex $AP + EC = AN$ subtrahatur AB radius evolutae in vertice B (per prob. praec.) determinandus, relinquitur BN.

Fiat valor ipsius $BN = v$, $CN = z$; et communis aequationum reductio dabit aequationem ad evolutam in pueris v & z atque constantibus.

Invenire radium circuli parabolam osculantis & aequationem ad ejus evolutam.

1. Quoniam $ax = y^2$ erit $a\dot{x} = 2y\dot{y}$ & $\frac{a\dot{x}}{2y} = \dot{y}$ & $\frac{a^2\dot{x}^2}{4y^2} = \dot{y}^2$ hoc est $\frac{a\dot{x}^2}{4x} = \dot{y}^2$. et si $\dot{x}$ sumatur pro constante, invenietur ob $\frac{a\dot{x}}{2\sqrt{ax}} = \dot{y}$ & $-\frac{a\dot{x}^2}{4x\sqrt{ax}} = \ddot{y}$ ergo $-\ddot{y} = \frac{a\dot{x}^2}{4x\sqrt{ax}}$

unde $\frac{\dot{x}^2 + \dot{y}^2}{-\ddot{y}} = \frac{4x\dot{x}^2 + a\dot{x}^2 \times 4x\sqrt{ax}}{4a\dot{x}^2} = \frac{a + 4x \times \sqrt{ax}}{a}$

$= \frac{ya+4xy}{a} = y + \frac{4xy}{a} = t = ME = PM + PE.$

Eſt vero $PM = y$. ergo $PE = \frac{4xy}{a}$ hoc eſt, quia $x = \frac{y^2}{a}$; $PE = \frac{4y^3}{a^2}$.

Conſtructio. Quoniam $PM = y$, $TP = \frac{2y^2}{a}$; ſi in T excitetur perpendicularis TE ipſi MP continuatæ occurrens in E; erit $PE = \frac{4y^4}{a^2 y} = \frac{4y^3}{a^2}$. Quodſi ergo ulterius in E & M excitentur perpendiculares EC & MC ad ME & MT; communis interſectio in C radium oſculi MC determinabit.

2. Quoniam EC ipſi PH parallela; erit ob $PH = \frac{a}{2}$

$PM : PH :: MC : EC$

$y : \frac{a}{2} :: y + \frac{4xy}{a} : \frac{a}{2} + 2x$ adeoque

$EC^2 = \frac{1}{4}a^2 + 2ax + 4x^2$

$ME^2 = ax + 8x^2 + \frac{16x^3}{a}$

$MC^2 = \frac{1}{4}a^2 + 3ax + 12x^2 + \frac{16x^3}{a}$ Jam cum MC coincidit in AB, hoc eſt quando radius evolutæ eſt AB, $x = 0$. Quare $AB^2 = \frac{1}{4}a^2$ & hinc $AB = \frac{1}{2}a$. Eſt adeo $BN = AP + PN - AB = 3x + \frac{1}{2}a - \frac{1}{2}a = 3x$. Sit jam $BN = v$, $CN = PE = z$: erit $v = 3x$, & $z = \frac{4x\sqrt{ax}}{a}$ $\frac{1}{3}v = x$, & $z = \frac{4}{3}v\sqrt{\frac{1}{3}av}$ & inde $3az = 4v\sqrt{\frac{1}{3}av}$, & $9a^2z^2 = \frac{16}{3}av^3$, & $9az^2 = \frac{16}{3}v^3$, & $27az^2 = 16v^3$.

En æquationem ad evolutam parabolæ Appollonianæ: unde intelligitur evolutam parabolæ Appollonii, eſſe parabolam Secundi generis, cujus parameter eſt $\frac{27}{16}$ parametri in parabola Appolloniana.

Invenire radium circuli MC cycloidem AMB oſculantis.

Sit diameter circuli genitoris $AB = 1$, $AP = x$ $PM = y$, erit $QP = \sqrt{x - x^2}$, arcus $AQ = \int \frac{dx}{2\sqrt{x - x^2}}$ adeoque

adeoque $PM = P2 + 2M = \sqrt{x - x^2} + \int \frac{\dot{x}}{2\sqrt{x - x^2}}$.

Quamobrem $y = \sqrt{x - x^2} + \int \frac{\dot{x}}{2\sqrt{x - x^2}}$ & ergo

$\dot{y} = \frac{\dot{x} - 2x\dot{x} + \dot{x}}{2\sqrt{x - x^2}} =$

$= \frac{2\dot{x} - 2x\dot{x}}{2\sqrt{x - x^2}} = \frac{\dot{x} \times 1 - x}{\sqrt{x}\sqrt{1 - x}} =$

$= \frac{\dot{x}\sqrt{1 - x}}{\sqrt{x}}$.

Quodsi ergo $\dot{x}$ Sumatur pro constante, reperietur $\ddot{y} = \frac{-\dot{x}^2\sqrt{x}}{2x\sqrt{1-x}} -$

$- \frac{\dot{x}^2\sqrt{1-x}}{2\sqrt{x}} =$

$= \frac{-2x\dot{x}^2 - 2\dot{x}^2 + 2x\dot{x}^2}{4x\sqrt{x - x^2}}$

$= \frac{-\dot{x}^2}{2x\sqrt{x - x^2}}$. unde

ob $\dot{x}^2 + \dot{y}^2 = \frac{\dot{x}^2 + \dot{x}^2 \times 1 - x}{x} =$

$= \frac{x\dot{x}^2 + \dot{x}^2 - x\dot{x}^2}{x} = \frac{\dot{x}^2}{x}$

erit $MC = *$

$= \frac{\dot{x}^2 + \dot{y}^2 \times \sqrt{\dot{x}^2 + \dot{y}^2}}{-\dot{x}\ddot{y}} =$

(per prob. 1. pag. 51. 52)

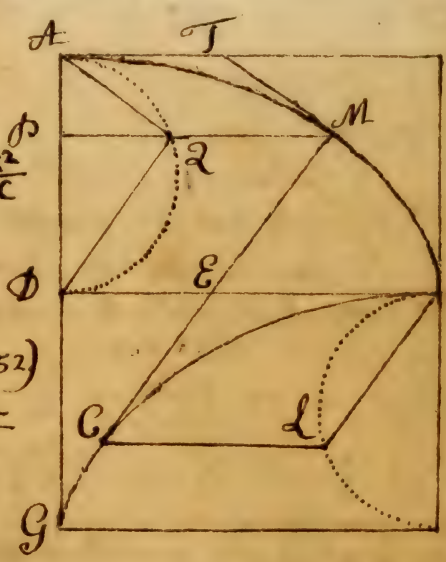
$= \frac{2\sqrt{x - x^2}}{\sqrt{x}} =$

$= 2\sqrt{1 - x}$.

$P\Phi^2 = 1 - 2x + x^2$

$P2^2 = x - x^2$ $\Phi 2^2 = 1 - x$ ergo $\Phi 2 = \sqrt{1 - x}$.

* posito $\frac{\dot{x}^2}{x} = \dot{x}^2 + \dot{y}^2$



Constructio.

Quoniam tangens TM ipsi A2 parallela $TM2 = A2\Phi$. Est vero $A2\Phi$ rectus: Ergo $2MC = P2\Phi$, consequenter MC ipsi 2D parallela, fiat $EC = EM$, erit C punctum in evoluta Cycloidis.

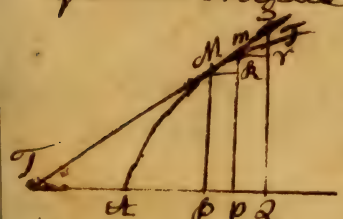
Corollarium. 1.

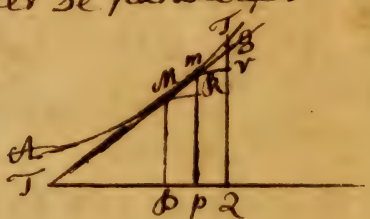
Si $x=0$; erit radius evoluta $2\sqrt{1}=2=2AB$, quia $AB=1$. Quare si BG fiat $=AB$; in G terminabitur evoluta ex una parte. Si $x=AB=1$; erit radius evoluta $=2\sqrt{1-1}=0$. Quare evoluta ex altera parte in B terminabitur.

Corollarium 2.

Quodsi BL ipsi $2D$ vel MC parallela ducatur, erit $\angle BBD=BB2$ adeoque arcus $2D$ & BL chordaq; cognomines, consequenter $BL=EC$ & hinc LC ipsi BE aequalis & parallela. Est vero BE arcui $2D$ adeoque & alteri BL aequalis. Quare $LC=$ arcui BL. Est itaque evoluta Cycloidis itidem Cycloidi aequalis & similis, hoc est Cycloidis sui evolutione seipsam describit.

Determinare punctum flexus contrarii in curvis, quarum ordinatae sunt inter se parallelae.





Sint duae curvae AMS quarum una axi concavitatem altera convexitatem obvertat. Ducatur tangens TM, sintque pM, pm & $2S$ infinite propinquae, $pp=p2$, hoc est x sit constans. Demittantur ex punctis curvarum M & m, perpendiculares MR & mr. Quoniam pm ipsi $2S$ parallela, erit $m=S$ (quia anguli sunt alterni). Sed $MR=mr$ (per hypoth.) ergo $mR=rS$. Est vero $Sr<Tr$, quando curva axi concavitatem obvertit, & $Sr>Tr$ quando curva axi convexitatem obvertit. Quamobrem in casu priore fluxio semiordinatarum y continuo decrescit, in posteriore autem crescit, sumta abscissa fluxio x pro constante. In puncto itaque flexus contrarii, fluxio semiordinatarum y est minimum aliquod, quando curva primum ad axem concava, deinde convexa; maximum vero aliquod, quando curva ad

axem

axem primum convexa, deinde concava. Invenitur adeo illud punctum Si fiat $\ddot{y}=0$ vel $\ddot{y}=\infty$, hoc eſt, Si Sumta $\dot{x}$ pro conſtante, valor ipſius $\dot{y}$ denuo differentietur.

Corollarium.

Quodſi aequatio ad curvam ignotam detur, invenire poteſt, utrum convexitatem, an concavitatem axi obvertat, Si ex aequatione differentiali eruatur ratio mv ad MR. E. gra. in parabola $ax=y^2$, & $a\dot{x}=2y\dot{y}$, & $\frac{a}{2y}=\frac{\dot{y}}{\dot{x}}$ hoc eſt $\frac{a}{2\sqrt{ax}}=\frac{\dot{y}}{\dot{x}}$ crescente adeo abſciſſa x, decreſcit ratio $\frac{a}{2\sqrt{ax}}$. Quare cum $\dot{x}$ Sit conſtans, (per hyp.) $\dot{y}$ decreſcere debet. Parabola igitur conſtanter concavitatem axi obvertit, adeoque punctum flexus contrarii non habet.

Determinare punctum flexus contrarii in curva, ad quam $ax^2=x^2+a^2y$. Erit $\frac{ax^2}{x^2+a^2}=y$, &

$$\frac{2ax^3\dot{x}+2a^2x\dot{x}-2ax^3\dot{x}}{\overline{x^2+a^2}^2}=\dot{y}, \text{ hoc eſt } \frac{2a^2x^2\dot{x}}{x^4+2x^2a^2+a^4}=\dot{y}.$$

Quodſi adeo $\dot{x}$ Sit conſtans, reperietur

$$\frac{2a^2x^4+4a^3x^2+2a^4x\dot{x}-8a^2x^4-8a^3x^2x\dot{x}}{\overline{xx+aa}^4}=\frac{2a^2-6a^3x^2-4a^2x^2x}{xx+aa}=\ddot{y}.$$

Quare $2a^2-6a^3x^2-4a^2x^2=0$ & (per $2a^2$ diviſa) $a^2-3x^2-2x^2=0$ & (per a^2+x^2 diviſa) $a^2-3x^2=0$, & $a^2=3x^2$ & $x=\sqrt{\frac{1}{3}a^2}$. Quod Si valor ipſius x^2 in aequatione data $ax^2=x^2+a^2y$ Subſtituatur, prodibit $\frac{1}{3}a^3=\frac{4}{3}a^2y$, $\frac{1}{3}a=\frac{4}{3}y$, $a=4y$, $\frac{1}{4}a=y$. Quare Si $\sqrt{\frac{1}{3}aa}$ & $\frac{1}{4}a$ jungantur ad angulos rectos, punctum flexus contrarii determinatur, utut curva nondum fuerit deſcripta.

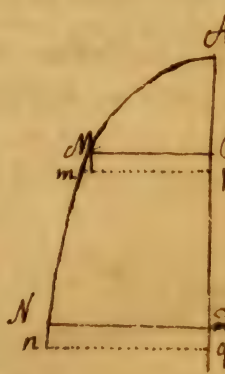
Determinare punctum flexus contrarii in curva ad quam $y-a=\overline{x-a}^{\frac{5}{3}}$. erit $\dot{y}=\frac{5}{3}\overline{x-a}^{\frac{2}{3}}\dot{x}$ Quodſi ergo $\dot{x}$ Sumatur pro conſtante, reperietur $\ddot{y}=\frac{-6}{25}\overline{x-a}^{-\frac{1}{3}}\dot{x}^2=0$, $\frac{-6}{25}\overline{x-a}^{-\frac{1}{3}}=0$, $-6=0$.

Quoniam

Quoniam nullus valor ipsius x prodit in hypothesi $\ddot{y}=0$; ponatur $\frac{-6\dot{x}^2}{25\sqrt[5]{x-a^7}}=\infty$, erit

$25\sqrt[5]{x-a^7}=0$, $x-a=0$, $x=a$.

Quadrare Segmentum Spatii parabolici PMN2 inter duas Semiordinatas PM & 2N interceptam



1. Sit AP constans $=b$, origo ipsius x in P, & hinc $P2=x$, $2N=y$, $A2=b+x$.

Sit porro parameter $=a$, erit $ab+ax=y^2$ & $\dot{x}y=\dot{x}\sqrt{ab+ax}$ ($\sqrt{ab+ax}=y$). Ut hoc elementum integrabile reddatur; fiat $\sqrt{ab+ax}=v$, ~~tum $ab+ax=$~~ tum $ab+ax=v^2$ & $a\dot{x}=2v\dot{v}$, & $\dot{x}=\frac{2v\dot{v}}{a}$ & $y\dot{x}=\frac{2v^2\dot{v}}{a}$ et inde $\int y\dot{x}=\frac{\frac{2}{3}v^3}{a}=\frac{\frac{2}{3}ab+ax\sqrt{ab-ax}}{a}=\frac{2}{3}b+x\sqrt{ab+ax}$

Quoniam in P $x=0$, & Spatium quoq; 2NMP evanescit; Si in integrali inventa ponatur $x=0$, quod relinquitur $\frac{2}{3}b\sqrt{ab}$, ostendit quid ei adjiciendum, ut Spatium 2NMP nihilum evadat in P, consequenter ut integrale fiat quadratura ipsius 2NMP. Habemus nempe in nostro casu Subtrahendum $\frac{2}{3}b\sqrt{ab}$: unde ipsius 2NMP area $=\frac{2}{3}b+x\sqrt{ab+ax}-\frac{2}{3}b\sqrt{ab}$.

2. Sit A2 constans $=b$, origo ipsius x in 2, erit $2P=x$, & $PN=y$, $AP=b-x$, & $ab-ax=y^2$, $\sqrt{ab-ax}=y$, $y\dot{x}=\dot{x}\sqrt{b-ax}$. fiat ut ante $ab-ax=v^2$, erit $-a\dot{x}=\dot{v}2v$, & $\dot{x}=\frac{-2v\dot{v}}{-a}$

&

& $y\dot{x} = -\frac{2v^2\dot{v}}{a}$ & $\int y\dot{x} = -\frac{\frac{2}{3}v^3}{a}$ et inde
$\int y\dot{x} = -\frac{2}{3}\overline{b-x}\sqrt{ab-ax} = \frac{2}{3}\overline{x-b}\times\sqrt{ab-ax}$.

Ut intelligatur, quid integrali Sit adjicien=
=dum, quo Spatii PMN2 menſuram conſti=
=tuat; ponatur ut ante $x=0$, relinquetur
$-\frac{2}{3}b\sqrt{ab}$. unde manifeſtum eſt, Si illi adji=
ciatur $+\frac{2}{3}b\sqrt{ab}$ haberi Spatium PMN2 =
$= \frac{2}{3}b\sqrt{ab} + \frac{2}{3}\overline{x+b}\times\sqrt{ab-ax}$.

Corollarium.

Quodſi adeo curva non ſupponatur deſcrip=
=ta, Sed tantum aequatio ad eam detur, ut
adeo non conſtet, ubi origo ipſius x Sit ſta=
=tuenda; evidens eſt, ex reſolutione problema=
=tis praeſentis, quod in integrali, poni debeat
$x=0$, & deletis iis, quae per x multiplicantur,
reſiduum Si quod fuerit, ſub ſigno contra=
=rio ipſi Sit adjiciendum, ut habeatur quadra=
=tura quaeſita.

Quadrare curvam ad quam $y^2 = x^4 + a^2x^2$.

Quoniam $y = x\sqrt{x^2+a^2}$ erit $y\dot{x} = x\dot{x}\sqrt{x^2+a^2}$
ut elementum integrabile reddatur, fiat
$\sqrt{x^2+a^2} = v$, $x^2+a^2 = v^2$, erit $2x\dot{x} = 2v\dot{v}$ &
$x\dot{x}\sqrt{x^2+a^2} = v\dot{v}$, $\int y\dot{x} = \frac{1}{3}v^3 = \frac{1}{3}\overline{x^2+a^2}\sqrt{x^2+a^2}$.
Ponatur $x=0$, erit reſiduum $\frac{1}{3}a^2\sqrt{a^2}$ Sive $\frac{1}{3}a^3$.
ergo quadratura curvae $\frac{1}{3}\overline{x^2+a^2}\sqrt{x^2+a^2} - \frac{1}{3}a^3$.

Of the length of curve lines, by Mr. Craig
in N° 289 of the Philoſophical tranſactions.
propoſita curva geometrica alias innumeras
longitudine aequales invenire.

Sint v, s, coordinatæ curvæ datæ; curvæ quæsitæ sint coordinatæ x, y; tum ex conditione problematis erit $\dot{v}^2+\dot{s}^2=\dot{x}^2+\dot{y}^2$ ponatur $\dot{x}=\dot{v}-m\dot{z}$, unde erit $\dot{y}=\sqrt{\dot{s}^2+2m\dot{v}\dot{z}-m^2\dot{z}^2}$; in hac pro $\dot{s}$, substituatur ejus valor per v, $\dot{v}$, & determinatis compositus, ut valores quantitatum $\dot{x}$, $\dot{y}$, sint summabiles: Et sic habentur x, & y, coordinatæ, quæsitæ curvæ. Q.E.I.

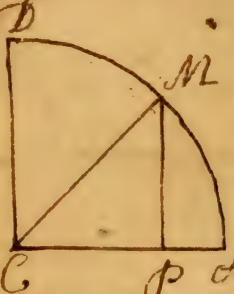
Exemplum 1.) Invenire curvam æqualem lineæ parabolicæ.

Sit $2a$ latus rectum parabolæ: adeoque $2as=v^2$ unde $2a\dot{s}=2v\dot{v}$ & $\dot{s}=\frac{v\dot{v}}{a}$ $\dot{s}^2=\frac{v^2\dot{v}^2}{a^2}$ adeoque

$\dot{y}=\sqrt{\frac{v^2\dot{v}^2}{a^2}+2m\dot{v}\dot{z}-m^2\dot{z}^2}$; ut hæc sit summabilis assumatur $m\dot{z}=\frac{v^2\dot{v}}{a^2}$ unde $\dot{x}=\dot{v}-\frac{v^2\dot{v}}{a^2}$. & $\dot{y}=\dot{v}\sqrt{\frac{v^2}{a^2}+\frac{2v^2}{a^2}-\frac{v^4}{a^4}}$, & $\dot{y}=v\dot{v}\sqrt{\frac{3a^2-v^2}{a^4}}$

Sit $\frac{3a^2-v^2}{a^4}=v^2$ tum $=\frac{v\dot{v}}{a^4}=v\dot{v}$ & $v\dot{v}=-a^4v\dot{v}$ & ejus $v\dot{v}\sqrt{\frac{3a^2-v^2}{a^4}}=-a^4v^2\dot{v}$ et ejus integrale $-\frac{a^4v^3}{3}=\frac{v^2-3a^2}{3a^2}\sqrt{3a^2-v^2}=y$, & $x=v-\frac{v^3}{3a^2}$.

Exemplum 2.) Invenire curvam æqualem circulari.



Circulum quadrare.

Sit $CA = 1 = r$ $CP = x$

et erit $y = \sqrt{1-x^2}$ &

ex $\sqrt{1-x^2}$ radice extracta

$$\sqrt{1-x^2} = 1 - \frac{x^2}{2} - \frac{x^4}{2.4.} - \frac{3x^6}{2.4.6.} - \frac{3.5x^8}{2.4.6.8.} \text{ &c.}$$

$$x\sqrt{1-x^2} = x - \frac{xx^2}{2} - \frac{xx^4}{2.4} - \frac{3xx^6}{2.4.6.} - \frac{5xx^8}{2.4.6.8} \text{ &c.}$$

Cujus integrale

$$x - \frac{x^3}{2.3.} - \frac{x^5}{2.4.5} - \frac{3x^7}{2.4.6.7.} - \frac{3.5x^9}{2.4.6.8.9.} - \frac{3.5.7x^{11}}{2.4.6.8.10.11} \text{ &}$$

est Spatio DCPM equale.

Quod si x radio equale evadit, Spatium DCPM. in quadrantem degeneret.

Sit t. tangens & arcus ejus

erit $= t - \frac{t^3}{3r^2} + \frac{t^5}{5r^4} - \frac{t^7}{7r^6} + \frac{t^9}{9r^8}$ &c.

Sit t = tangent. $30^\circ = r\sqrt{\frac{1}{3}}$ $t^3 = \frac{1}{3}r\sqrt{\frac{1}{3}}$

$t^5 = \frac{1}{9}r\sqrt{\frac{1}{3}}$

Sit $r = 1$ & v = arcui & c = cosin. y = Sinu

tam

$$v = y + \frac{y^3}{6} + \frac{3y^5}{40} + \frac{5y^7}{112} + \frac{35y^9}{1152} + \frac{63y^{11}}{2816} + \frac{231y^{13}}{13312}$$

$$y = v - \frac{v^3}{6} + \frac{v^5}{120} + \frac{v^7}{5040} + \frac{v^9}{362880} - \frac{v^{11}}{39916800} + \text{ &c.}$$

$$c = 1 - \frac{1}{2}v^2 + \frac{1}{24}v^4 + \frac{1}{720}v^6 + \frac{1}{40320}v^8 - \frac{1}{362880}v^{10} + \text{ &c}$$

Lemma.] Duorum quadratorum Summam, in alia duo quadrata dividere.

Sint $\dot{z}^2$, $\dot{s}^2$ duo quadrata data, quorum Summa $\dot{z}^2+\dot{s}^2$ dividenda est in alia duo quadrata $\dot{x}^2+\dot{y}^2$: Sintque m & n, duo quilibet numeri ad arbitrium sumendi. Jam ex conditione problematis, est $\dot{x}^2+\dot{y}^2=\dot{z}^2+\dot{s}^2$, (unde ut ex Diophanto constat) erit

$$\dot{x}=\frac{\overline{m^2-n^2}\times\dot{z}+2mn\dot{s}}{m^2+n^2} \text{ \& } \dot{y}=\frac{\overline{n^2-m^2}\times\dot{s}+2mn\dot{z}}{m^2+n^2}.$$

Problema.] Curvas innumeras invenire, quæ sint ejusdem longitudinis cum curva quavis proposita, sive algebraica, sive transcendente.

Designent z, s, coordinatas curvæ propositæ, & x, & y, coordinatas curvæ quæsitæ, quæ ejusdem sit longitudinis cum proposita; unde ex curvarum elementis $\dot{x}^2+\dot{y}^2=\dot{z}^2+\dot{s}^2$, ideoque per Lemma præcedens

$$\dot{x}=\frac{\overline{m^2-n^2}\times\dot{z}+2mn\dot{s}}{m^2+n^2}; \text{ \& } \dot{y}=\frac{\overline{n^2-m^2}\times\dot{s}+2mn\dot{z}}{m^2+n^2},$$

Quarum integrales sunt

$$x=\frac{\overline{m^2-n^2}\times z+2mns}{m^2+n^2}, \quad y=\frac{\overline{n^2-m^2}\times s+2mnz}{m^2+n^2}.$$

The Logarithm of the Ratio of $\sqrt{ab}$ to $\frac{a+b}{2}$ or $\frac{1}{2}z$ when $\frac{1}{4}z^2+ab=y^2$ will be found $\frac{1}{m}\times\frac{1}{y^2}+\frac{1}{3y^6}+\frac{1}{5y^{10}}+\&$ where $\frac{1}{m}$ is to be multiplied into every term of the Series, and for making Brigs's Logarithms m is equall to the hyperbolick Logarithm of 10 which is

$m=2,302585092994045684017$

$\&\ \frac{1}{m}=0,434294481903251,827651$

N.	Log.
1	0,000 &c.
2	0,30102.99956.63981.19521.37388.
3	0,47712.12547.19662.43729.50279.
5	0,69897.00043.36018.80478.62611.
7	0,84509.80400.14256.83071.22162.
11	1,04139.26851.58225.04075.01999.
13	1,11394.33523.06836.76920.65051.
17	1,23044.89213.78273.92854.01698.
19	1,27875.36009.52828.96153.63334
23	1,36172.78360.17592.87886.77771.
29	1,46239.79978.98956.08733.28467.
31	1,49136.16938.34272.67966.67041.
37	1,56820.17240.66994.99680.84506.
39	1,59106.46070.26499.20650.15330.
41	1,61278.38467.19735.49450.94118.
43	1,63346.84555.79586.52640.50881.
47	1,67209.78579.35717.46441.42193.
51	1,70757.01760.97936.36583.51977.
53	1,72427.58696.00789.04563.29922.
57	1,75587.48556.72491.39883.13613.
59	1,77085.20116.42144.19026.06563.
61	1,78532.98350.10767.03388.67485.
67	1,82607.48027.00826.43414.91316.
69	1,83884.90907.37255.31616.28050.
71	1,85125.83487.19075.28609.28294.

N	Log.
77	1,88649.07251.72481.87146.24162.
79	1,89762.70912.90441.42799.48213.
83	1,91907.80923.76073.90383.27603.
87	1,93951.92526.18618.52462.78746.
89	1,94939.00066.44912.78472.35433.
93	1,96848.29485.53935.11696.17320.
97	1,98677.17342.66244.85178.43618
101	2,00432.13737.82642.57427.51881.
103	2,01283.72247.05172.20517.10711.
107	2,02938.37776.85209.64083.45412.
109	2,03742.64979.40623.63520.05133
113	2,05307.84434.83419.72279.52270
127	2,10380.37209.55956.80[illegible]24.69874
131	2,11727.12956.55764.202[illegible]8.52626.
137	2,13672.05671.56406.76886.29256.
139	2,13401.48002.54095.08048.64332.
149	2,17318.62684.12274.03825.73635.
151	2,17897.69472.93169.43686.90730.
157	2,19589.96524.09233.73676.14811.
163	2,21218.76044.03957.80764.22629.
167	2,22271.64711.47583.27998.40759.
173	2,23804.61031.28822.01456.05302.
179	2,25285.30309.79893.16957.03826.
181	2,25767.85748.69184.51028.97436.
191	2,28103.33672.47727.53763.50435.
193	2,28555.73090.07773.76059.72386.
197	2,29446.62261.61592.92737.17443.
199	2,29885.30764.09706.65010.00217.

To find the number answering to any Log. of Brigg's form.

Seek the next neareſt Log. and call its number a, if greater, or b, if leſſer than the given L. and the difference thereof from the ſaid neareſt Log. call l. then

as $0,434\&c - \frac{1}{2}l$ to $,434\&c + \frac{1}{2}l :: a$ } to the num=
or as $0,434\&c + \frac{1}{2}l$ to $,434\&c - \frac{1}{2}l :: b$ } =ber ſought.

John Ward Says.

the Cord of $\frac{1}{258280326}$ part of the Circles perifery, whose diameter is 2 is =to ,000000024326999289832033.
the perimeter of the inscribd poligon is equal to 6,283185307179585 9.
the perimeter of the circumscribd poligon is =6,283185307179586 5.
The arch of 1° =0,0174532925199 4 (6134
The arch of 0° 01' =0,0002908882086657215
The arch of 10° =0,1745329251994 3
The arch of 30° =0,5235987755982 9

To extract the cube root of 67507824239

the nearest Cube 64 — 67'507'824'239 (4000 less than just
4000x3=12000) 3507824239 (292318,68
the first root 4)
+0) 2923 18,68 (4071
40) 2923
+7 2849
407) 7418
+1) 4071
4071) 3347,68
+8 3254,44 &c.
The root =4071,8

The Radius of of a Circle containing an Acre is 7,136 Rods.

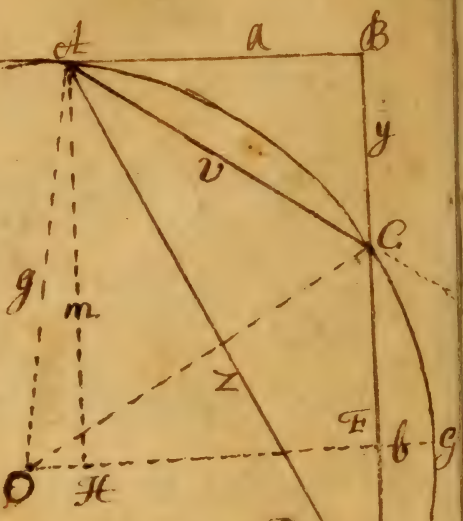
The top of an hill, a mile in perpendicular height, may be Seen from the earths Sur=face 89,213 miles if the earths diameter be 7969 miles. And 89,44 if it be 8000.
And 2 miles high may be Seen 126,2.
And 6 feet high, 3 miles & 47 feet.

As Radius to the Tang. of 9° 00' 30 is the Sine of the Lattitude to the Sine of the Suns declination (South) when twilight is Shorteft.

If any angle of a triangle be biffected, the biffecting line will divide the op=posite Side in the Same proportion as the legs of the angle are to one another.

If the vertical angle of any triangle be biffected the difference of the rect=angles made by the Sides and the Seg=ments of the base, is equal to the Square of the line that biffects the angle.

In Triangulo rectan=
=gulo ACD, datis
AB=a, & CD=b, &
sinu anguli CAB=s;
invenire BC=y



Sit AC=v AB=z
Sit O centrum circu=
=culi ACD & OA=OG
=g OF=h HO=k
AH=m, Sit ACD
rectus & BC=x
& CF=½b

Angulus COG=CAD per 20.3. Euclid.
& ergo s:r::½b: $\frac{rb}{2s}$=CO=g
& s:c::½b: $\frac{cb}{2s}$=OF=h & AB=HF
per constr. ergo h-a=OH=k & $g^2-k^2=m$
ergo $m=\sqrt{g^2+k^2}$=AH & m=y+½b &
y=m-½b

Aliter,

r:s::z:x=$\frac{sz}{r}$
v:a::b:x=$\frac{ab}{v}$ ergo $\frac{sz}{r}=\frac{ab}{v}$ &
rab=svz & $v=\sqrt{a^2+y^2}$ & $z=\sqrt{a^2+y^2+2by+b^2}$
$\frac{rab}{s}=vz$
& $vz=\sqrt{a^2+y^2}\times\sqrt{a^2+y^2+2by+b^2}$

$\frac{r^2a^2b^2}{s^2}=v^2z^2=a^4+y^4+2a^2y^2+2by^3+b^2y^2+2ba^2y+b^2a^2$

$y^4+2by^3+2a^2y^2+b^2y^2+2ba^2y=\frac{r^2a^2b^2}{s^2}-a^4+b^2a^2$

quod Si a assumeretur radice quæsita major radicum expressiones provenirent.

$\sqrt{aaa-b} = \frac{1}{2}a + \sqrt{\frac{1}{4}aa - \frac{b}{2a}}$ vel $a - \frac{ab}{3aa-b}$

$\sqrt[3]{a^3-b} = \frac{2}{3}a + \sqrt{\frac{1}{9}aa - \frac{b}{6aa}}$ vel $a - \frac{ab}{4a^4 - \frac{3}{2}b}$.

&c. Sic de reliquis

The amount of one pound for one Day at the rate of 6 per Cent. per ann. compound interest is 1,000159 65352

Months	The amount of 1l. at 6 per Cent. for months
1	1,00486755053
2	1,00973581942
3	1,01467384621
4	1,01961282224
5	1,02457556394
6	1,02956301141
7	1,03457440911
8	1,03961030776
9	1,04467066314
10	1,04975536501
11	1,05486438941
12	1,06

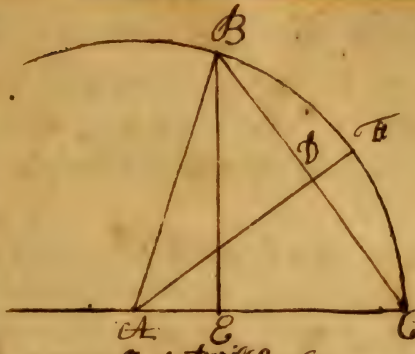
John Osborn
His Book
1733

John Osborn

John Osborn 1734

Book
1734

John Osborn 1734
John Osborn



Lemma.

The Sine of the double of any arch, is equal to twice the Sine of that arch into its Co-Sine, divided by radius; And the verfed Sine of the double of any arch, is equal to twice the Square of the Sine thereof divided by radius.

Let the arch BC, be double the arch BE, and A, the center of the circle. Let AB, the radius $= r$, and BE $=$ (the Sine of the arch BC) $= y$, EC its verfed Sine $= x$, AD $= z$, BD $= v$. The angle EBC will always equal ABD, and the triangles BCE, and ABD, are Similar, wherefore $r : z :: 2v : y$, ergo $y = \frac{2vz}{r}$. Q. E. D. And $r : v :: 2v : x$, ergo $x = \frac{2v^2}{r}$. Q. E. D.

1° The horozontal diftance of projections made with the fame velocity, at Several elevations of the line of direction; are as the Sines of the doubled angles of elevation.

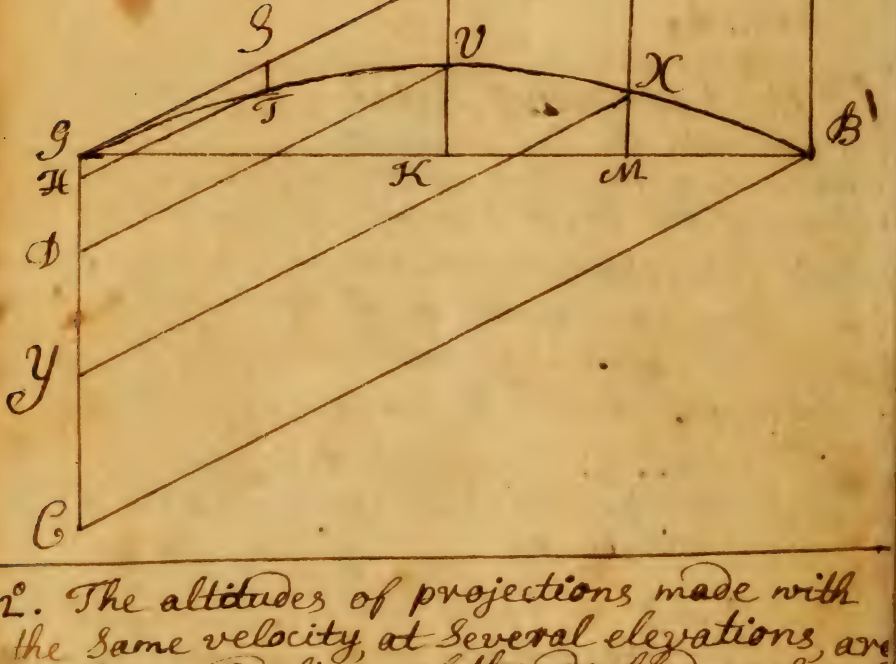
Let GB (figur. Sequen.) the horozontal diftance $= z$, the Sine of the angle of elevation EGB $= s$, its cofine $= c$, radius $= r$, and the parameter $= p$. it will be $c : s :: z : \frac{sz}{c} = FB = GC$. now $c : r :: z : \frac{rz}{c} = GE$, & its Square $\frac{z^2r^2}{c^2}$ will be therefore equal $= \frac{psz}{c}$: which equation reduced will be $\frac{psc}{r^2} = z$. but by the former Lemma $\frac{2sc}{r}$ is equal to the Sine of the double angle whereof s is the Sine: wherefore it will be, as radius to the Sine of double the

angle

angle F G B, So is half the parameter to the horozontal range, or distance Sought: as at the Several elevations, the ranges are as the Sines of the double angles of elevation.

Q. E. D.

Coroll.) hence it follows that half the parameter is the greatest random, & that that happens at the elevation of 45° the Sine of whose double is radius. Also that the ranges above & below equally distant from 45° are equal, as are the Sines of all doubled arches, to the Sines of their doubled compliments.



2. The altitudes of projections made with the Same velocity, at Several elevations, are the verSed Sines of the doubled angles of ction.

As

As $c:s::\frac{PSC}{rr}=GB:\frac{PSS}{rr}=BF$. and $VK=KV=\frac{1}{4}BF$, the altitude of the projection $=\frac{PSS}{4rr}$. Now by the foregoing lemma $\frac{2SS}{r}$ = the verſed ſine of the double angle; and therefore it will be, as radius to the verſed ſine of double the angle FGB, ſo is $\frac{1}{8}$ of the parameter to the height of the projection VK; and ſo theſe heights at at ſeveral elevations are as the ſaid verſed ſines. Q. E. D.

Corroll.) Hence it is plain, the greateſt altitude of the perpendicular projection is a 4^{th} of the parameter, or half the greateſt horizontal range: the verſed ſine of 180 degrees being equal to 2r.

The lines GF or times of the flight of a project caſt with the ſame degree of velocity at different elevations, are as the ſines of the the elevations.

As $c:r::\frac{PSC}{rr}=GB$ (by prop. 1.) $:\frac{PS}{r}=GE$, that is as radius to the ſine of elevation, ſo is the parameter to the line GF; ſo the lines GF are as the ſines of elevation, and the times are proportional to thoſe lines. wherefore the times are as the ſines of elevation: ergo conſtat propoſitio

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Prob. I.

A pojection being made as you pleaſe, having the diſtance, and altitude or deſcent of an object, thro which the project paſſes together with the angle of elevation of the line of direction: to find the parameter & velocity; (having the angle FGB,) GM, & MX.

Solution.) As radius to the Secant of FGB, So is GM the distance given, to GL, and as radius to the tangent of FGB, So is GM to LM. Then LM − MX in heights or + MX in descents: Or else MX − LM if the direction be below the horizontal line, is the fall in the time that the direct impulse given in G, would have carried the project from G to L, = LX = GY: then by reason. of the parabola; as LX or GY is to GL or YX: So is GL to the parameter sought: to find the velocity of the impulse, find the time in seconds that a body would fall the Space LX, and by that dividing the line GL, the quote will be the velocity, or Space moved in a Second sought, which is always a mean proportional between the parameter and 16 feet one inch.

Problem II.

Having the parameter, horizontal distance, & height or descent of an object: to find the elevations of the lines of direction necessary to hit the given object: that is having GM, MX and the greatest random equal to half the parameter; to find the angles FGB.

Let the tangent of the angle Sought equal t, the horizontal distance GM = b, the altitude of the object MX = h, the parameter = p, & radius = r, and it will be, as $r : t :: b : \frac{tb}{r} = ML$. and $\frac{tb}{r} \mp h \left\{\begin{matrix}\text{in ascents}\\ \text{in descents}\end{matrix}\right\} = LX$, and $\frac{ptb}{r} \mp ph = GL \cdot v. = XY \cdot q.$ (ratione parabola) but $bb + \frac{t^2b^2}{r^2} = GL \cdot q.$ (by 47. 1. Eucl.) wherefore $\frac{ptb}{r} \mp ph = b^2 + \frac{t^2b^2}{r^2}$. which equation transposed, is $\frac{t^2b^2}{r^2} = \frac{ptb}{r} \mp ph - b^2$; which divided by bb is

is $\frac{t^2}{r^2} = \frac{pt^2}{br} + \frac{ph}{b^2} - 1$. this equation shews the question to have two answers, and the roots thereof are $\frac{t}{r} = \frac{p}{2b} \pm \frac{\sqrt{p^2 \pm 4ph}}{4b^2} - 1$; which I derive the following rule from. Divide half the parameter by the horizontal distance & keep the quote, viz. $\frac{p}{2b}$; then say, as the Square of the distance given to half the parameter, so is half the parameter $\left.\begin{matrix} - \\ + \end{matrix}\right\}$ double $\left\{\begin{matrix} \text{height} \\ \text{descent} \end{matrix}\right\}$ to the Square of a Secant $= \frac{p^2 \pm 4ph}{4b^2}$, the tangent answering to that Secant will be $\frac{\sqrt{p^2 \pm 4ph}}{4b^2} - 1$ or rr: So then the Sum & difference of the afore-found quote & this tangent, will be the root of the equation, & the tangents of the elevation sought.

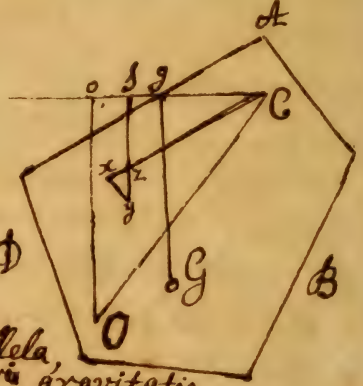
Note here, that in descents, if the tangent exceed the quote, as it doth when ph [illegible] is more than bb, the direction of the lower elevation will be below the horizon; & if $ph = b^2$ it must be directed horizontal, and the tangent of the upper elevation will be $\frac{pr}{b}$:

Note like-wise, that if $4b^2 + 4ph$ in ascents, or $4b^2 - 4ph$ in descents, be equal to pp, there is but one elevation that can hit the object, and its tangent is is $\frac{pr}{2b}$; and if $4b^2 + ph$ in ascents, & $4b^2 - 4ph$ in descents, do exceed pp, the object is without the reach of a project cast with that velocity, and so the thing impossible.

De centro Oscillationis.

Philos. Transf. N° 33

Prop. 1.] In corporis oscillantis datâ quâvis inclinatione ad horizontem, invenire punctum, cujus acceleratio perinde sit, ac si ab ipsius propriâ tantum gravitate urgeatur.



Sit ABD corporis propositi sectio in plano ad horizontem perpendiculari, in quo moveatur centrum gravitatis G, centro suspensionis existente C. Distinguatur corpus in elementa prismatica plano ABD perpendicularia, adeoque horizonti semper parallela, ut facile patebit ex motu centri gravitatis G in plano illo ABD. Atque ob hujusmodi situm, tale elementum quodvis spectari potest tanquam punctum physicum p in plano eodem ABD ad punctum z locatum. Reducatur itaque corpus propositum in planum physicum ABD constans ex hujusmodi particulis p.

In hoc plano, ut inveniatur O, cujus acceleratio propria non mutatur ab actionibus particularum reliquarum, attendendum est ad vires particulæ cujusvis singularis p in puncto z sitæ: Nam ex hisce viribus conjunctis oritur plani totius, motus absolutus, cujus ope datur motus puncti cujusvis proposita; unde vicissim invenitur punctum cujus motus est datus.

At urgetur particula p a vi propria gravitatis; quæ si partium cohæsio dissolveretur, in dato tempore minimo datam produceret accelerationem motûs in perpendiculari ad horizontem xy. Ad Cz duc normalem yx, & resolvetur acceleratio zy in partes zx & xy. Ob corporis rigiditatem, tollitur vis zx per resistentiam puncti C: At vi reliquâ xy trahitur spatium ABD in gyrum circa punctum C. et ductâ horizontali Cg & perpendiculari zS, erit ea ut $\frac{Cg}{Cz}$: Nempe ob gravitatis vim datam & similia triangula xyz & gCz. Ergo vis particulæ p ad movendum spatium ABD. est ut $\frac{Cg}{Cz} \times p$: Ad has vires in unum colligendas, sit O punctum invariabile, in lineâ ad libitum ducta

ductâ, et ad distantiam adhuc incognitam CO. Tum erit vis particula p ad movendum punctum O, ut $\frac{Cz}{CO} \times \frac{Cs}{Cz} \times p$, hoc est ut $\frac{Cs}{CO} \times p$. Acceleratio autem, quam tribuit p, eidem puncto O, erit ut $\frac{CO}{Cz} \times \frac{Cs}{Cz}$. itaque applicatâ vi illa $\frac{Cs}{CO} \times p$ ad hanc accelerationem $\frac{CO \times Cs}{Czq}$, erit quotiens $\frac{Czq}{COq} \times p$ particula, qua, si in ipso puncto O fingatur moveri cum eadem accelerazione $\frac{CO \times Cs}{Czq}$, eundem omnino produ=cevet motum, quem in eodem puncto O producit particula p. Hinc demum reducitur problema ad ad motuum theorema notissimum: Applicata enim Summa virium $\frac{Cs}{CO} \times p$ ad Summam particularum $\frac{Czq}{COq} \times p$, erit quotiens accelerazio absoluta puncti O.

Dein ductâ perpendiculari Oo, & positâ hac accele=ratione aquali data accelerazioni $\frac{Co}{CO}$ ipsius punc=ti O, dabitur distantia CO. Sit enim $\frac{Co}{CO} = D$, et (juxta methodum fluxionum) $Cs \times p = M$, & $Czq \times p = C$. Tum ob CO invariabilem, erit Summa omnium virium $\frac{Cs}{CO} \times p = \frac{M}{CO}$, & Summa omnium particula=rum $\frac{Czq}{COq} \times p = \frac{C}{COq}$.

unde applicata Summâ momentorum ad Summam corporum, erit $\frac{M}{C} \times CO = D$, adeoque $CO = \frac{DC}{M}$. Invertis igitur C & M, per fluxionium methodum inversam, dabitur CO. Q. E. I.

Cor.] A Centro gravitatis G ad horizontalem Co duc perpendicularem Gg, & sit corpus ipsum $ABE = A$. Tum ex notissimâ indole centri gravi=tatis erit $M = Gg \times A$ unde $CO = \frac{DC}{Gg \times A}$.

Prop.

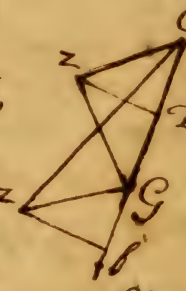
Prop. 2.] Iisdem positis, quaeratur punctum O in rectâ CG transeunte per centrum gravitatis G, tum erit O centrum oscillationis corporis A.

Etenim in hoc casu sit $\frac{Go}{CO} = \frac{Gg}{CG} = \delta$; unde $CO = \left(\frac{C}{CG \times A}\right.$ per cor. prop. 1.$\left.\right) \frac{C}{CG \times A}$.

At datur A, & dato puncto C, dantur CG, & quantitas C. Unde datur GO, qualiscunque sit corporis oscillantis inclinatio ad horizontem. Ideoque est O centrum oscillationis corporis A. Q. E. D.

Prop. 3.] Iisdem positis, sit Φ aggregatum omnium $Gz q_i \times p$ tum erit $CO = CG + \frac{\Phi}{CG \times A}$.

Ad CG duc normalem zF, atque erit $Cz q_i = CG q_i + GF q_i - 2CG \times GF$, nempe cadente F intra C & G.



At ubi F cadit in CG producta, erit $Cz q_i = CG q_i + Gf q_i + 2CG \times Gf$.

est ergo C = (aggregato omnium $Cz q_i \times p$) aggregato omnium $CG q_i \times p - 2CG \times Gf \times p$

At ob centrum gravitatis G, est aggregatum omnium $2CG \times GF \times p =$ aggregato omnium $2CG \times Gf \times p$. Quare est C = aggregato omnium $CG q_i \times p + Gz q_i \times p = CG q_i \times A + \Phi$. At per prop. 2. est $CO = \frac{C}{CG \times A}$ ergo $CO = CG + \frac{\Phi}{CG \times A}$. Q. E. D.

Cor.] hinc datur parallelogrammum $CG \times GO$. est enim $GO = \frac{\Phi}{CG \times A}$. At dantur A & Φ. quare datur $CG \times GO = \frac{\Phi}{A}$.

Prop. 4.

Prop. 4.] Iisdem positis, si in puncto O constitu-
-atur particula physica $\frac{CG \times A}{CO}$ quæ propriâ
gravitate agitata oscillet circa punctum C; Spatii
ABC motas perinde omnino erit, ac si agitaretur
ab oscillatione ipsius corporis A.

Constat tam ex natura centri gravitatis, quam
per prop. 1. est enim $\frac{CG \times A}{CO}$ aggregatum omnium
$\frac{Czq \times p}{COq} = \frac{C}{COq}$.

Sit z Log. cujusvis fractionis $\frac{a}{a+1}$ & x Log. Denominatoris. fiat ad libitum $y = 2a+1$

tum $z = -2x\frac{1}{m}x\frac{1}{y} + \frac{1}{3y^3} + \frac{1}{5y^5} + \frac{1}{7y^7} + \&c.$

et $x = La + 2x\frac{1}{m}x\frac{1}{y} + \frac{1}{3y^3} + \frac{1}{5y^5} + \frac{1}{7y^7} + \&c.$

ubi 2 multiplicari supponitur in singulos seriei terminos

To find the Log. of two, the first prime number.

$a = 1 \quad 2a = 2 \quad y = 3$

$\frac{1}{m} = 0,434294481903251828\ \&c.$

$2x\frac{1}{m} = ,868588963806503656\ \&c.$

$\frac{1}{y} = \frac{1}{3}$

$\frac{1}{3}$ of ,868588963806 5

$\frac{1}{3}$ of ,289529654602 1 , 289529654602 1

$\frac{1}{3}$ of — 32169961622 4 ÷ 3 = · 107233205408

$\frac{1}{3}$ of — 3574440180 2 ÷ 5 = — 714888036 0

$\frac{1}{3}$ of — 397160020 0 ÷ 7 = — 56737145 7

$\frac{1}{3}$ of — 44128891 1 ÷ 9 = — 4903210 1

490321 01 ÷ 11 = — 44574 63

54480 11 ÷ 13 = — — — 4190 77

6053 34 ÷ 15 = — — — 403 55

672 59 ÷ 17 = — — — 39 57

74 95 ÷ 19 = — — — 3 94

8 32 ÷ 21 = — — — 39

9 2 ÷ 23 = — — — 4

10

The Log. of 2 is = 0,301029995636

Mr. Truchet has shewn, by the rules of Combination, that two Square Stone divided diagonally into two colours, may be joined together chequer-wise 64 different ways. but there are only 32 different figures.

The Resistances of any figure whatever going now with its base foremost & then with its vertex, are as the figures of the base to the Sum of all the cubes of the Elements of the base divided by the Squares of the Elements of the curve line.

The resistance of a Square moved according to the direction of its Side & of its diagonal, is as the diagonal to the Side.

The resistance of a circular Segment, less than a Semicircle carried in a direction perpendicular to its basis, when it goes with the base foremost & then with the vertex foremost, (the same direction & celerity continuing;) is as the Square of the diameter to the same, less $\frac{1}{3}$ of the Square of the base of the Segment. Hence the resistances of a Semicircle when its base & when its vertex go foremost, are to one another in a Sesquialterate ratio.

Probl. I.

Datum	1	$b - cx = \square$ quere x.
Sit	2	$b - cx = e^2$
$2 + cx$	3	$b = cx + e^2$
$3 - e^2$	4	$b - e^2 = cx$
$4 \div c$	5	$x = \frac{b - e^2}{c}$

Probl. II.

Datum	1	$b + cx = \square$ quere x.
Sit	2	$b + cx = e^2$
$2 - b$	3	$cx = e^2 - b$
$3 \div c$	4	$x = \frac{e^2 - b}{c}$

Probl. III.

Datum	1	$x^2 + cx = \square$ quere x.
Sit	2	$e - x = \sqrt{x^2 + cx}$
$2 \odot^2$	3	$e^2 - 2ex + x^2 = x^2 + cx$
$3 - x^2$	4	$e^2 - 2ex = cx$
$4 + 2ex$	5	$e^2 = cx + 2ex$
$5 \div c + 2e$	6	$x = \frac{e^2}{c + 2e}$

Probl. IV.

Datum	1	$x^2 - cx = \square$. quere x
Sit	2	$e - x = \sqrt{x^2 - cx}$
$2 \odot^2$	3	$e^2 - 2ex + x^2 = x^2 - cx$
$3 - x^2$	4	$e^2 - 2ex = -cx$
$4 + 2ex$	5	$e^2 = 2ex - cx$
$5 \div 2e - c$	6	$x = \frac{e^2}{2e - c}$

Probl. V.

Datum	1	$cx - x^2 = \square$. quere x
Sit	2	$ex - x = \sqrt{cx - x^2}$
$2 \odot^2$	3	$e^2x^2 - 2ex^2 + x^2 = cx - x^2$
$3 \div x$	4	$e^2x - 2ex + x = c - x$
$4 + x$	5	$e^2x - 2ex + 2x = c$
$5 \div e^2 - 2e + 2$		$x = \frac{c}{e^2 - 2e + 2}$

Datum	1	$x^2 + b = \square$ quere x
Sit	2	$x + e = \sqrt{x^2 + b}$
$2 \odot^2$	3	$x^2 + 2xe + e^2 = x^2 + b$
$3 - x^2$	4	$2xe + e^2 = b$
$4 - e^2$	5	$2xe = b - e^2$
$5 \div 2e$	6	$x = \frac{b - e^2}{2e}$

Probl. VI.

Datum	1	$x^2 - b = \square$ quere x
Sit	2	$e - x = \sqrt{x^2 - b}$.
$2 \odot^2$	3	$e^2 - 2ex + x^2 = x^2 - b$
$3 - x^2$	4	$e^2 - 2ex = -b$
$4 + 2ex$	5	$e^2 = 2ex - b$
$5 + b$	6	$e^2 + b = 2ex$
$6 \div 2e$	7	$x = \frac{e^2 + b}{2e}$

Probl. VII.

Data	1	$b - x = \square$
	2	$c - x = \square$ quere x
	3	$c \sqsupset b$
1–2	4	$b - c =$ diff. duor. quadrator.
Sit	5	$\sqrt{b - x} = y$ & $\sqrt{c - x} = z$

tum per precedentes duas, erit

$$y = \frac{b - c + e^2}{2e} \text{ \& } z = \frac{b - c - e^2}{2e}$$

Probl. VIII.

Datum	1	$b^2 - x^2 = \square = y^2$ quere x
Sit	2	$b - ex = \sqrt{b^2 - x^2} = y$ vel $ex - b = y$
$2 \odot^2$	3	$b^2 - 2bex + e^2x^2 = b^2 - x^2 = y^2$
$3 - b^2$	4	$-2bex + e^2x^2 = -x^2$
$4 - e^2x^2$	5	$-2bex = -e^2x^2 - x^2$
$5 \mid +$	6	$2bex = e^2x^2 + x^2$
$6 \div x$	7	$2be = e^2x + x$
$7 \div e^2 - 1$	8	$x = \frac{2be}{e^2 + 1}$ & $y = b - \frac{2be^2}{e^2 + 1}$

Probl. IX.

By 8 steps

Probl. X.

Data	1	$x^2+b=\square$
	2	$x^2=c$
		} quere x
Sit	3	$x+e=\sqrt{x^2+b}$
3 $\odot^2$	4	$x^2+2xe+e^2=x^2+b$
4 $-x^2$	5	$2xe+e^2=b$
5 $-e^2$	6	$2xe=b-e^2$
6 $\div 2e$	7	$x=\frac{b-e^2}{2e}$
2 ww^2	8	$x=\sqrt{c}$
7 & 8	9	$\frac{b-e^2}{2e}=\sqrt{c}$
9 $\times 2e$	10	$b-e^2=2e\sqrt{c}$
10 $+e^2$	11	$b=2e\sqrt{c}+e^2$
11 $+c$	12	$b+c=c+2e\sqrt{c}+e^2$
12 ww^2	13	$\sqrt{b+c}=\sqrt{c}+e$
13 $-\sqrt{c}$	14	$\sqrt{b+c}-\sqrt{c}=e$
14	15	$e=\sqrt{b+c}-\sqrt{c}$

Probl. XI.

Data	1	$x^2+b=\square$
	2	$x^2=d$
		} quere x
Sit	3	$x+e=\sqrt{x^2+b}$
tum	4	$x=\frac{b-e^2}{2e}$ per precedentem resolut.
&	5	$\frac{b-e^2}{2e}=\sqrt{d}$ per 2da & 4th Steps
inde	6	$b=2e\sqrt{d}+e^2$
6 $+d$	7	$b+d=d+2e\sqrt{d}+e^2$
7 ww^2	8	$\sqrt{b+d}=\sqrt{d}+e$
8 $-\sqrt{d}$	9	$\sqrt{b+d}-\sqrt{d}=e$
9	10	$e=\sqrt{b+d}-\sqrt{d}$ per changing Sides.

Datum	1	$bx^2+cx=\square$ quare x
pone	2	$x+ex=\sqrt{bx^2+cx}$
$2\,\textcircled{2}$	3	$x^2+2ex^2+e^2x^2=bx^2+cx$
$3\div x$	4	$x+2ex+e^2x=bx+c$
$4-bx$	5	$x+2ex+e^2x-bx=c$
$5\div 1+2e+e^2-b$	6	$x=\frac{c}{1+2e+e^2-b}$

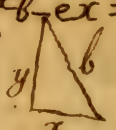
Probl. XII

Data	1	$x^2+y^2=b^2$
	2	$xy=ac$
	* 3	$x=\frac{2be}{e^2+1}$ per Probl. IX.
$2\div y$	4	$x=\frac{ac}{y}$
3 & 4	5	$\frac{ac}{y}=\frac{2be}{e^2+1}$
$5\times y$	6	$ac=\frac{2bey}{e^2+1}$
$6\times e^2+1$	7	$ace^2+ac=2bey$
$7\div 2be$	8	$y=\frac{ace^2+ac}{2be}$

quere x & y.

Prob. XIII.

Sit $b-ex=y$ &



Inuestiga

Prob. XIV

Datum	1	$bx^2+c^2=\square=y^2$ quare x
Sit	2	$ex+c=\sqrt{bx^2+c^2}=y$
$2\,\textcircled{2}$	3	$e^2x^2+2ecx+c^2=bx^2+c^2$
$3-c^2$	4	$e^2x^2+2ecx=bx^2$
$4\div x$	5	$e^2x+2ec=bx$
$5-e^2x$	6	$2ec=bx-e^2x$
$6\div b-e^2$	7	$x=\frac{2ec}{b-e^2}$

from Kersey's explication of Diophantus

Problem I.

Datum	1	$x^2+y^2=\square^2$ Quære x & y.
Singe &	2	$ra=x$
	3	$sa-\square=y$
Quæ 2^{do}	4	$r^2a^2=x^2$
3^{do}	5	$s^2a^2-2sa\square+\square^2=y^2$
4 + 5	6	$s^2a^2-2sa\square+\square^2+r^2a^2=x^2+y^2=\square^2$
6 − $\square^2$	7	$s^2a^2-2sa\square+r^2a^2=0$
7 + $2sa\square$	8	$s^2a^2+r^2a^2=2sa\square$
8 ÷ a	9	$s^2a+r^2a=2s\square$
9 ÷ s^2+r^2	10	$a=\frac{2s\square}{s^2+r^2}$
10 × r	11	$ra=\frac{2rs\square}{s^2+r^2}=x$
10 × $s-\square$	12	$sa-\square=\frac{2s^2\square}{s^2+r^2}-\square=y$
per 12th	13	$sa-\square=\frac{s^2\square-r^2\square}{s^2+r^2}$

Let s & r equal any two unequal numbers, they Solve the Prob.

per 47th Euclid I.

		Hyp.	Base	perpend. of a right angled △
	13	c, $\frac{s^2\square-r^2\square}{s^2+r^2}$,		$\frac{2rs\square}{s^2+r^2}$,
		Hyp.	Base	perpend
13 × s^2+r^2	14	$s^2\square+r^2\square$,	$s^2\square-r^2\square$,	$2rs\square$
14 ÷ $\square$	15	s^2+r^2,	s^2-r^2,	$2rs$,

Proof

s^2+r^2 $^{\square 2}$	is	$=s^4+2s^2r^2+r^4$
s^2-r^2 $^{\square 2}$	is	$=s^4-2s^2r^2+r^4$
$2rs$ $^{\square 2}$	is	$=4s^2r^2$

The first of which Squares is manifestly equal to the Summ of the other two.

Problem II.

Datum	1	$a^2+b^2=x^2+y^2$ Quere x & y
finge	2	$ra+b=x$
&	3	$sa-d=y$ or $d+sa$
2 a^2	4	$r^2a^2+2rab+b^2=x^2$
3 a^2	5	$s^2a^2-2sad+d^2=y^2$
4 + 5	6	$r^2a^2+2rab+b^2+s^2a^2-2sad+d^2=x^2+y^2$
by 6th 1	7	$r^2a^2+2rab+b^2+s^2a^2-2sad+d^2=a^2+b^2$
7 − b^2+d^2	8	$r^2a^2+2rab+s^2a^2-2sad=0$
8 + $2sad$	9	$r^2a^2+2rab+s^2a^2=2sad$
9 ÷ a	10	$r^2a+2rb+s^2a=2sd$
10 − $2rb$	11	$r^2a+s^2a=2sd-2rb$
11 ÷ r^2+s^2	12	$a=\frac{2sd-2rb}{r^2+s^2}$
per 2d &		
12th Steps	13	$x=\frac{2rsd+s^2b-r^2b}{r^2+s^2}$
per 3d & 12th	14	$y=\frac{s^2d-r^2d\ \backsim\ 2rsb}{r^2+s^2}$

Problem III.

Data	1	$d^2=x^2+y^2$
Data	2	$x\sqsubset f$
Data	3	$x\sqsupset g$
		} Quere x & y
per Prob. 1. 3d	4	$x=\frac{2rsd}{s^2+r^2}$
& fac	5	$r=1$
sum per 4 & 5	6	$x=\frac{2sd}{s^2+1}$
per 2d & 6th	7	$\frac{2sd}{s^2+1}\sqsubset f$ per 3d & 6

per 3d & 6	8	$\frac{2\delta d}{\delta^2+1} \sqsupset g$
7 × δ^2+1	9	$2\delta d \sqsubset \delta^2 f + f$
9 Sides change	10	$\delta^2 f + f \sqsupset 2\delta d$
10 ÷ f	11	$\delta^2 + 1 \sqsupset \frac{2\delta d}{f}$
11 − 1	12	$\delta^2 \sqsupset \frac{2\delta d}{f} - 1$
12 − $\frac{2\delta d}{f}$	13	$\delta^2 - \frac{2\delta d}{f} \sqsupset -1$
13 + $\frac{d^2}{f^2}$	14	$\delta^2 - \frac{2\delta d}{f} + \frac{d^2}{f^2} - 1$
14 ww²	15	$\delta - \frac{d}{f} \sqsupset \sqrt{\frac{d^2}{f^2} - 1}$ or $\frac{d}{f} - \delta \sqsupset \sqrt{\frac{d^2 - f^2}{f}}$
15 + $\frac{d}{f}$	16	$\delta \sqsupset \frac{d}{f} + \sqrt{\frac{d^2 - f^2}{f}}$
by 15	17	$\frac{d}{f} - \delta \sqsupset \sqrt{\frac{d^2 - f^2}{f}}$
17 + δ	18	$\frac{d}{f} \sqsupset \sqrt{\frac{d^2 - f^2}{f}} + \delta$
18 − $\sqrt{\frac{d^2 - f^2}{f}}$	19	$\frac{d}{f} - \sqrt{\frac{d^2 - f^2}{f}} \sqsupset \delta$
19	20	$\delta \sqsubset \frac{d}{f} - \sqrt{\frac{d^2 - f^2}{f}}$

Same method as got the 16th Step with f, with g will get

per 3d & 5th	21	$\delta \sqsubset \frac{d}{g} + \sqrt{\frac{d^2 - g^2}{g}}$

and the Same as obtain'd the 20th Step with f, with g will get

per 3d & 4th	22	$\delta \sqsupset \frac{d}{g} - \sqrt{\frac{d^2 - g^2}{g}}$

Now the 16th & 21st Steps give a Canon for limiting the Number $\S$, when $r=1$ viz.

Canon I.

$$\S \sqsupset \frac{d+\sqrt{d^2-f^2}}{f}$$

$$\S \sqsubset \frac{d+\sqrt{d^2-g^2}}{g}$$

Now if $\S$ be taken any number within these limits, and substituted in the 6th Step, x will be found to solve the Problem.

Again from the 20th & 22d Steps is derived another Canon for limiting $\S$, when $r=1$ viz.

Canon II.

$$\S \sqsubset \frac{d-\sqrt{d^2-f^2}}{f}$$

$$\S \sqsupset \frac{d-\sqrt{d^2-g^2}}{g}$$

Problem IV.

Data	1	$d^2+b^2=x^2+y^2$
	2	$x \sqsubset f$
	3	$x \sqsupset g$
		Quere x & y.
per Prob. 2	4	$x=\frac{2r\S d+\S^2 b-r^2 b}{\S^2+r^2}$
pone	5	$r=1$
per 4 & 5	6	$x=\frac{2\S d+\S^2 b-b}{\S^2+1}$
per 2 & 6	7	$\frac{2\S d+\S^2 b-b}{\S^2+1} \sqsubset f$
per 3 & 6	8	$\frac{2\S d+\S^2 b-b}{\S^2+1} \sqsupset g$

$7 \times \sqrt{s^2+1}$	9	$2\sqrt{d} + s^2 b - b \sqsubset s^2 f + f$
$9 + b$	10	$2\sqrt{d} + s^2 b \sqsubset s^2 f + f + b$
$10 - s^2 b$	11	$2\sqrt{d} \sqsubset s^2 f - s^2 b + f + b$
assume	12	$c = f - b$
11 & 12	13	$2\sqrt{d} \sqsubset s^2 c + f + b$
$13 - f + b$	14	$2\sqrt{d} - f - b \sqsubset s^2 c$
$14 \div c$	15	$\frac{2\sqrt{d}}{c} - \frac{f+b}{c} \sqsubset \frac{s^2 c}{c}$ or s^2
$15 - \frac{2d}{c} s$	16	$-\frac{f+b}{c} \sqsubset s^2 - \frac{2d}{c} s$
$16 + \frac{d^2}{c^2}$	17	$\frac{d^2}{c^2} - \frac{f+b}{c} \sqsubset s^2 - \frac{2d}{c} s + \frac{d^2}{c^2}$
17 ut w^2	18	$\sqrt{\frac{d^2 - fc - bc}{c^2}} \sqsubset s - \frac{d}{c}$
$18 + \frac{d}{c}$	19	$\frac{d}{c} + \sqrt{\frac{d^2 - fc - bc}{c^2}} \sqsubset s$
19 mutatis vicibus	20	$s \sqsupset \frac{d}{c} + \sqrt{\frac{d^2 - fc - bc}{c^2}}$
ita rursum 17 ut w^2	21	$\sqrt{\frac{d^2 - fc - bc}{c^2}} \sqsubset \frac{d}{c} - s$
$21 + s$	22	$s + \sqrt{\frac{d^2 - fc - bc}{c^2}} \sqsubset \frac{d}{c}$
$22 - \sqrt{\frac{d^2 - fc - bc}{c^2}}$	23	$s \sqsubset \frac{d}{c} - \sqrt{\frac{d^2 - fc - bc}{c^2}}$
pone	24	$n = g - b$

Now from the eight Step & 24th may be deduced

	25	$s \sqsubset \frac{e}{n} + \sqrt{\frac{d^2 - gn - bn}{n^2}}$ by the same

method of reasoning as obtained the 23d Step.

Then from the 20th & 25th Steps, after c & n are exchang'd for their equals f−b & g−b by position in the 12th & 24th Steps ariseth canon I. for limiting $\int$, when $r = 1$ viz.

Canon I.

$$\int = \frac{d + r\sqrt{d^2 - b^2 - f^2}}{f - b}$$

$$\int = \frac{d + r\sqrt{d^2 - b^2 - g^2}}{g - b}$$

Again from the 23d & 26th Steps ariseth

Canon II.

$$\int = \frac{d - \sqrt{d^2 + b^2 - f^2}}{f - b}$$

$$\int = \frac{d - \sqrt{d^2 + b^2 - g^2}}{g - b}$$

Problem V.

Datum	1	$x^2 - y^2 = d$ Quære x & y
Sit	2	$x = y + a$
$1 + y^2$	3	$x^2 = d + y^2$
$2 \quad a^2$	4	$x^2 = y^2 + 2ya + a^2$
3 & 4	5	$y^2 + 2ya + a^2 = d + y^2$
$5 - y^2$	6	$2ya + a^2 = d$
$6 - a^2$	7	$2ya = d - a^2$

$7 \div 2a$

7 : 2a	8	$y = \frac{d - a^2}{2a}$ hence a may be any number $\sqsubset \sqrt{b}$
2 & 8	9	$x = \frac{d + a^2}{2a}$
Si poſſidum Sit	10	$d = ac$
tum 9 & 10	11	$\frac{1}{2}c + \frac{1}{2}a = x$ & $\frac{1}{2}c - \frac{1}{2}a = y$

For farther illuſtration of the two preceeding Steps.

$\frac{1}{2}c + \frac{1}{2}a^{\square 2}$	12	$\frac{1}{4}c^2 + \frac{1}{2}ca + \frac{1}{4}a^2$ Hypoth	of a right angled Triangle
$\frac{1}{2}c - \frac{1}{2}a^{\square 2}$	13	$\frac{1}{4}c^2 - \frac{1}{2}ca + \frac{1}{4}a^2$ Baſe & perpend	
12 − 13	14	$+ ca$	

Or thus

$c + a^{\square 2}$	15	$c^2 + 2ca + a^2$	which alſo conſtitute a right angled Triangle per 47. 1. Euclid
$c - a^{\square 2}$	16	$c^2 - 2ca + a^2$	
15 − 16	17	$+ 4ca$	

Problem VI.

Data	1	$x \times y = d$
	2	$\frac{x + y}{2} \sqsubset \sqrt{b}$
1 ÷ x	3	$y = \frac{d}{x}$
2 & 3	4	$\frac{x + \frac{d}{x}}{2} \sqsubset \sqrt{b}$
4 reduc'd	5	$\frac{x^2 + d}{2x} \sqsubset \sqrt{b}$
5 × 2x	6	$x^2 + d \sqsubset 2x\sqrt{b}$
6 − d	7	$x^2 \sqsubset 2x\sqrt{b} - d$
7 − 2x√b	8	$x^2 - 2x\sqrt{b} \sqsubset -d$
8 + b	9	$x^2 - 2x\sqrt{b} + b \sqsubset b - d$

$9\ w^2$	10	$x - \sqrt{b} \sqsubset \sqrt{b - d}$
$10 + \sqrt{b}$	11	$x \sqsubset \sqrt{b} + \sqrt{b - d}$
$9\ w^2$	12	$\sqrt{b} - x \sqsubset \sqrt{b - d}$
$12 + x$	13	$\sqrt{b} \sqsubset x + \sqrt{b - d}$
$13 - \sqrt{b - d}$	14	$\sqrt{b} - \sqrt{b - d} \sqsubset x$
14 mutato vicē	15	$x \sqsupset \sqrt{b} - \sqrt{b - d}$

Canon for limiting x

$x \sqsubset \sqrt{b} + \sqrt{b - d}$
$x \sqsupset \sqrt{b} - \sqrt{b - d}$

} now any number between these two quantities may be taken for x.

Problem VII.

Data	1	$x^2 - y^2 = d$
	2	$x^2 \sqsubset b$
$2\ w^2$	3	$x \sqsubset \sqrt{b}$
	4	$x = \frac{d + a^2}{2a}$ per Problem V.
3 & 4	5	$\frac{d + a^2}{2a} \sqsubset \sqrt{b}$ hence

$a \sqsubset \sqrt{b} + \sqrt{b - d}$
$a \sqsupset \sqrt{b} - \sqrt{b - d}$

} vid. Prob VI. Steps 5th, 11th and 15th.

Problem VIII.

Data	1	$b+x=\square$ quod pone $=a^2$ } Quere
	2	$f+x=\square$ quod pone $=e^2$ } x
1 − b	3	$x=a^2-b$
2 − f	4	$x=e^2-f$
3 & 4	5	$a^2-b=e^2-f$
5 + f	6	$a^2-b+f=e^2$
Sit	7	$e=a-c$ vel $c-a$
7 a^2	8	$e^2=a^2-2ac+c^2$
6 & 8	9	$a^2-2ac+c^2=a^2-b+f$
9 − a^2	10	$-2ac+c^2=-b+f$
10 + $2ac$	11	$c^2=2ac-b+f$
11 + $b-f$	12	$c^2+b-f=2ac$
12 ÷ $2c$	13	$a=\frac{c^2+b-f}{2c}\sqsubset\sqrt{b}$ per 3^{a} Step
in order to		find the limits of c
put	14	$d=b-f$
13 & 14	15	$\frac{c^2+d}{2c}\sqsubset\sqrt{b}$
15 × $2c$	16	$c^2+d\sqsubset 2c\sqrt{b}$
16 − d	17	$c^2\sqsubset 2c\sqrt{b}-d$
17 − $2c\sqrt{b}$	18	$c^2-2c\sqrt{b}\sqsubset -d$
18 + b	19	$c^2-2c\sqrt{b}+b\sqsubset b-d$
19 $\sim$	20	$c-\sqrt{b}\sqsubset\sqrt{b-d}$
20 + $\sqrt{b}$	21	$c\sqsubset\sqrt{b}+\sqrt{b-d}$
19 $\sim$	22	$\sqrt{b}-c\sqsubset\sqrt{b-d}$

22+c	23	$\sqrt{b} = c + \sqrt{b-d}$
23−√b−d	24	$\sqrt{b} - \sqrt{b-d} = c$
mutato vice	25	$c = \sqrt{b} - \sqrt{b-d}$
per 14 & 21	1st 26	$c = \sqrt{b} + \sqrt{f}$ } non taking c below these limits & finding a by the 12th & e by the 4th Step, x may be found by the 2d or 4th
per 14 & 25	27	$c = \sqrt{b} - \sqrt{f}$

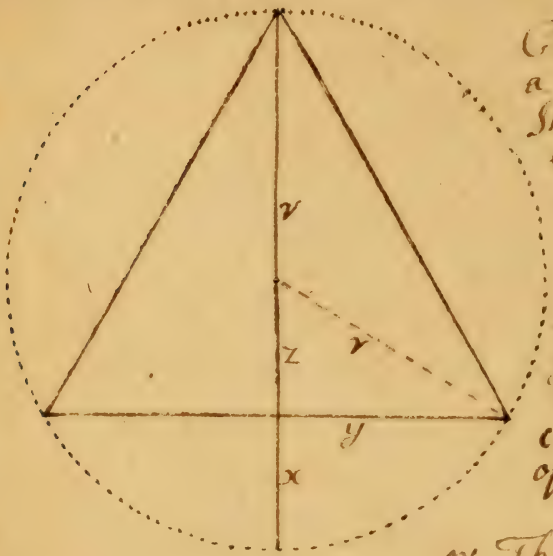
Problem VIII. reassumed

Data {	1	$b+x = \square = a^2$ } & Sit $a^2 = e^2$
	2	$f+x = \square = e^2$ } vel $b = f$
1−2	3	$b-f = a^2 - e^2$ = different. decor. quad.
& Sit	4	$a = e + c$
tum per	Prob. V.	
erit	5	$a = \frac{b-f+c^2}{2c}$
et	6	$e = \frac{b-f-c^2}{2c}$

and from the 6th Step it appears that

$c^2 = b-f$ or $c = \sqrt{b-f}$.

non taking c any number less than $\sqrt{b-f}$ a may be found by the 5th Step & then x by the 1st Step; e by the 4th & then x by the 2d.



In a given Circle, to inscribe a triangle, which shall be the greatest that can be inscribed therein.

Or to find, when the Triangle is greatest, where its base shall cut the diameter of the circle.

$r^2 - z^2 = y^2$

$\sqrt{r^2 - z^2} = y$

$r + z$ = to the height of the Triangle

$\overline{r+z} \times y$ = to the Triangle

$\overline{r+z} \times y = \overline{r+z}\sqrt{r^2 - z^2}$

$\dot{z}\sqrt{r^2 - z^2} + \frac{-z\dot{z}}{\sqrt{r^2 - z^2}} \times r + z$

$\dot{z}\sqrt{r^2 - z^2} - \frac{rz\dot{z} + z^2\dot{z}}{\sqrt{r^2 - z^2}} = 0$

$\sqrt{r^2 - z^2} - \frac{rz + z^2}{\sqrt{r^2 - z^2}} = 0$

$r^2 - z^2 - \overline{rz + z^2} = 0$

$r^2 - z^2 = rz + z^2$

$r^2 = rz + 2z^2$

$\frac{r^2}{2} = \frac{r}{2}z + z^2$

$z = \frac{3}{4}r - \frac{1}{4}r = \frac{1}{2}r$

Or Thus to find x

$2rx - x^2 = y^2$

$y = \sqrt{2rx - x^2}$

$\overline{2r - x} \times y = \overline{2r - x}\sqrt{2rx - x^2}$

its fluxion

$0 = \frac{2r^2\dot{x} - 3rx\dot{x} + x^2\dot{x}}{\sqrt{2rx - x^2}} - \dot{x}\sqrt{2rx - x^2}$

$\frac{2r^2 - 3rx + x^2}{\sqrt{2rx - x^2}} - \sqrt{2rx - x^2} = 0$

$2r^2 - 3rx + x^2 - 2rx - x^2 = 0$

$2r^2 - 3rx + x^2 = 2rx - x^2$

$2r^2 + x^2 = 5rx - x^2$

$2r^2 = 5rx - 2x^2$

$r^2 = \frac{5}{2}rx - x^2$ hence

$x = \frac{1}{2}r$

To find where the basis, of a Cone inscribed in a Sphere, shall cut the axis of the Sphere, so that the Cone may be the greatest that can be inscribed in that Sphere.

N. B. The basis of the cone will be always as y^2 and the Cone it self as the heigth into y^2 i.e.

as $2r-x \times y^2$

$y^2 = 2rx - x^2$

$\overline{2r+x} \times \overline{2rx-x^2} =$

$4r^2x - 4rx^2 + x^3$

whose fluxion

is $4r^2\dot{x} - 8rx\dot{x} + 3x^2\dot{x} = 0$

$4r^2 - 8rx + 3x^2 = 0$

$4r^2 = 8rx - 3x^2$

$\frac{4}{3}r^2 = \frac{8}{3}rx - x^2$

$\sqrt{\frac{16}{9}r^2 - \frac{12}{9}r^2} = \frac{4}{3}r - x$

$\sqrt{\frac{4}{9}r^2} = \frac{4}{3}r - x$

$\frac{2}{3}r = \frac{4}{3}r - x$

$\frac{2}{3}r + x = \frac{4}{3}r$

$x = \frac{4}{3}r - \frac{2}{3}r = \frac{2}{3}r$

or thus $r^2 - z^2 = y^2$

$\overline{r+z} \times \overline{r^2 - z^2} =$

$r^3 + r^2z - rz^2 - z^3$ whose

fluxion $r^2\dot{z} - 2rz\dot{z} - 3z^2\dot{z} = 0$

$r^2 - 2rz - 3z^2 = 0$

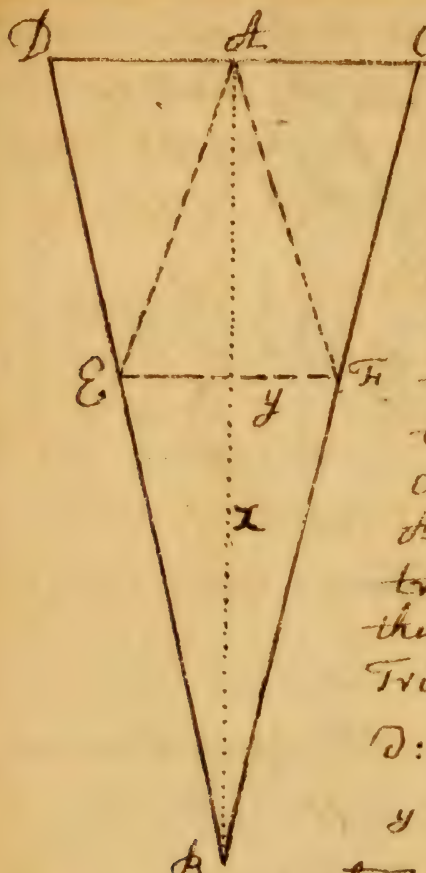
$r^2 = 2rz + 3z^2$

$\frac{1}{3}r^2 = \frac{2}{3}rz + z^2$ hence

$z = \sqrt{\frac{1}{9}r^2 + \frac{3}{9}r^2} - \frac{1}{3}r$

$z = \sqrt{\frac{4}{9}r^2} - \frac{1}{3}r$

$z = \frac{2}{3}r - \frac{1}{3}r = \frac{1}{3}r$



Let BDC be an Isoceles triangle, and the line BA bisect the Base DC at right angles tis required to find where the Base EF of the Isoceles triangle AEF shall cut the line AB, when AEF is the greatest triangle that can be thus inscribd in the Triangle BDC.

Find $AB = b$
& $AC = d$

$$d : b :: y : x$$

$$y = \frac{dx}{b}$$

$$b - x \times y = \frac{bdx - dx^2}{b}$$

$$\frac{bd\dot{x} - 2dx\dot{x}}{b} = 0$$

$$bd\dot{x} - 2dx\dot{x} = 0$$

$$bd - 2dx = 0$$

$$bd = 2dx$$

$$x = \frac{bd}{2d} = \frac{b}{2}$$

If BIC be an inverted cone, BA its axis, and AEF the greatest cone that can be thus inscribed therein tis required to find where the base EF muft cut the axis BA.

Let BA = b & AC = d

then $d : b :: y : x$ & $y = \frac{dx}{b}$

& $y^2 = \frac{d^2x^2}{b^2}$

& $b - x \times y^2 = \frac{bd^2x^2 - d^2x^3}{b^2}$

$$\frac{bd^2 2x\dot{x} - d^2 3x^2\dot{x}}{b^2} = 0$$

$$bd^2 2x\dot{x} - d^2 3x^2\dot{x} = 0$$

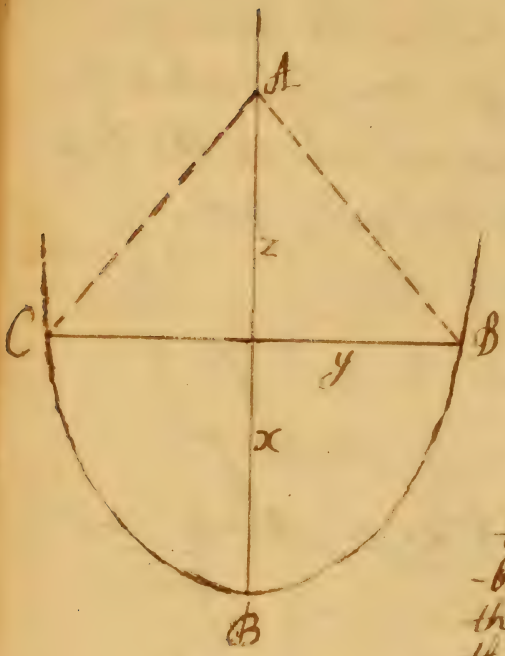
$$bd^2 2x - d^2 3x^2 = 0$$

$$2bx - 3x^2 = 0$$

$$2b - 3x = 0$$

$$3x = 2b$$

$$x = \frac{2}{3}b$$



Let the curve C B D be an Apollonian parabola but its Axis, & a given point in its axis, to be made the vertex of the Isoceles triangle A C D.

It is required to find where C D must cut the Axis of the Parabola when A C D is the greatest triangle that can be thus inscribed in the given Parabola.

Given A B = b
the Equation defining a parabola $ax = y^2$
hence $y = \sqrt{ax}$
$b - x \times y = b - x \times \sqrt{ax}$
its fluxion

$$-\dot{x}\sqrt{ax} + \frac{ab\dot{x} - ax\dot{x}}{2\sqrt{ax}} = 0$$

$$-\sqrt{ax} + \frac{ab - ax}{2\sqrt{ax}} = 0$$

$$-2ax + ab - ax = 0$$
$$3ax = ab$$
$$3x = b$$
$$x = \tfrac{1}{3}b$$

Or thus
$z \times y$ = to the triangle
$x = b - z$ and $ax = ab - az$
$y = \sqrt{ab - az} = \sqrt{ax}$
$zy = z\sqrt{ab - az}$ its fluxion

$$\dot{z}\sqrt{ab - az} + \frac{-az\dot{z}}{2\sqrt{ab - az}} = 0$$

$$\sqrt{ab - az} + \frac{-az}{2\sqrt{ab - az}} = 0$$

$$2ab - az - az = 0$$
$$2ab - 2az - az = 0$$
$$2ab - 3az = 0$$
$$2b - 3z = 0$$
$$3z = 2b$$
$$z = \tfrac{2}{3}b$$

Let A be a point given in the axis of a parabolick Conoid. ACD the greatest cone that can be therein inscribed with its vertex at A.

It is required to find where the basis CD of the cone shall cut AB the axis of the conoid.

$ax = y^2$

$b - x \times ax$ is as y cone

its fluxion is

$ab\dot{x} - 2ax\dot{x} = 0$

$ab - 2ax = 0$

$b - 2x = 0$

$x = \frac{1}{2}b$

Or thus zy^2 is as the cone

$y = ax = ab - az$

$zy^2 = ab^2z - az^2z$

its fluxion

$ab^2\dot{z} - 2az\dot{z} = 0$

$ab - 2az = 0$

$b - 2z = 0$

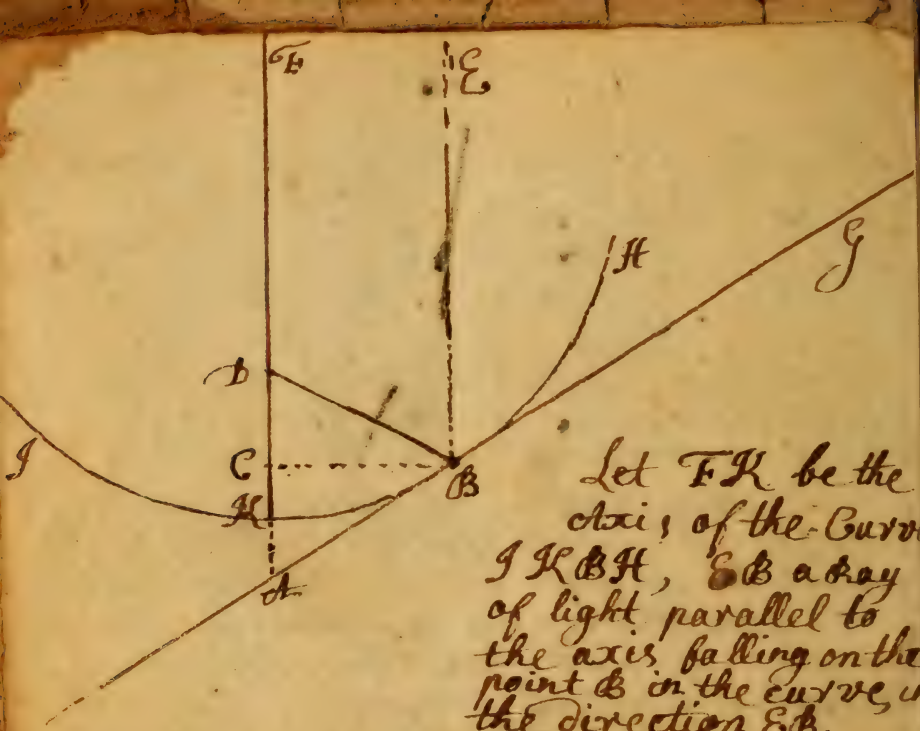
$z = \frac{1}{2}b.$

In Making the Regulus Antimonii Stellatus (as Saith Salmon) Antimon. ℥XVI and Iron ℥viii after one purifi=cation, afford Regulus ℥10; Scoria ℥13. and ℥XV. of Scoria yield ℥xii & ℥ij of Sulphur. Auratum. In Making the Sulph. Aurat the Scoria may be boild in 16 times its weight of water. Salmon.

Carnes, cartilagines, offa, pelles, diu cocta in aceto, deliquescunt tandem; inque Spissum rediguntur liquidum. Boerhave.

Acidum Aceti per vim ignis ab ære expul-sum, vix mutatum, & relinquit as tantum reductum in pulverem, cæterum non mu-tatum. Id nullo alio corpore, quam Solo cupro, fieri potest quantum ejus Scio: Aurum, Argentum, Mercurius, Stannum non recipiunt: Ferrum, autem & plum-bum, illud quidem in se recipiunt admit-tunt, Sed ita mutant, ut deinde acidum inde recipi nequeat purum acetosum, Sed longe aliud quid. Boerhaave

O milk most joy most nonsuch joy
The kind caresses of a Spouse you love?
In a fond Ear Breast there will be to hear
The loveing creature cry my life! My dear!
So See a little Fire about thy brow
And those pearly Drops all pour down
Then Charmed your Eyes upon your Cheeks to See
How every creature can express Such Be-



Let FK be the axis of the Curve IKBH, EB a Ray of light parallel to the axis falling on the point B in the curve, in the direction EB.

Draw the Tangent ABG to the curve in the point B, and Make the angle ABD = EBG

I Say that the Angle DBA is equil to the angle DAB.

For the Angle DAB = EBG and the angle DBA = EBG Ergo DBA = DAB. Q.E.D.

An horse for 5£ a mare 13 l. a Colt 5 l. how many of each Sort may be bought for 20£?

$\frac{1}{5}a + \frac{3}{4}e + \frac{1}{4}y = 20$

if $a = 1$. then $\frac{3}{4}e + \frac{1}{4}y = 15$

or $3e + y = 60$

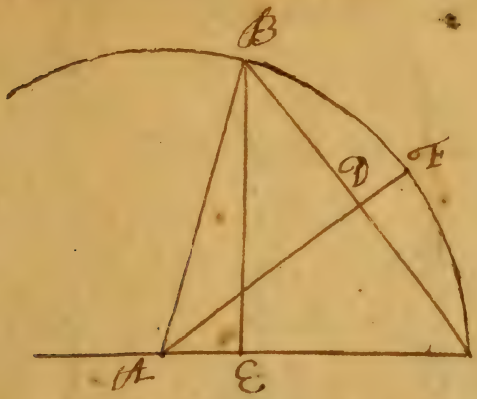
Let a	e	y
1	19	3
	18	6
	1	57

Let a

a	e	y
2	13	1
	12	4
	1	37

Let a

a	e	y
3	6	2
	5	5
	1	17



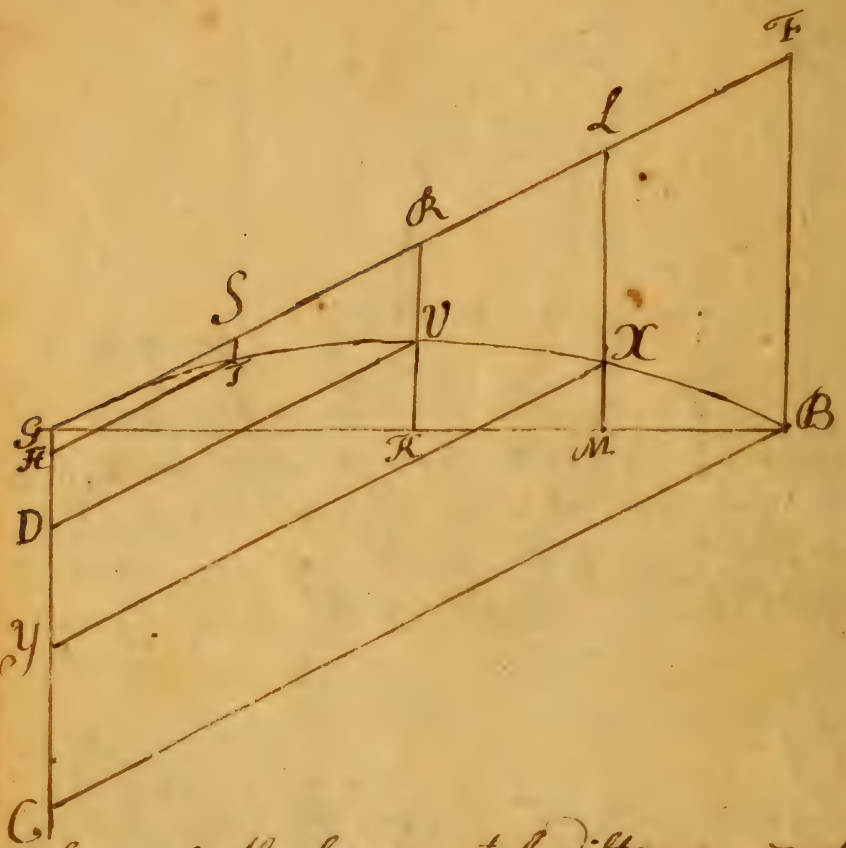
Lemma.

The Sine of the double of any arch, is equal to twice the Sine of that arch into its Co-Sine, divided by radius; and the verfed Sine of the double of any arch, is equal to the Square of the Sine thereof divided by radius.

Let the arch BC, be double the arch BF, A the center of the circle. Let AB the radius = r, BE the Sine of the arch BC = y, EC its verfed Sine = x, AD = z, BD = v. The angle ~~EBC~~ DBC will always equal ABD, and the triangles BCE, & ABD, are Similar; wherefore $r : z :: 2v : y$, ergo $y = \frac{2vz}{r}$ 2. E. D. And $r : v :: 2v : x$, ergo $x = \frac{2vv}{r}$. 2. E. D.

The horizontal diftance of projections made with the Same velocity, at Several elevations of the line of direction, are as the Sines of the doubled angles of elevation.

Let



Let GB the horizontal distance = z, the Sine of the angle of elevation FGB = s, its co-Sine = c, radius = r, & the parameter = p. it will be $c : s :: z : \frac{sz}{c} = FB = GC$. Now $c : r :: z : \frac{rz}{c} = GF$, and its Square $\frac{zzrr}{cc}$ will be therefore $= \frac{psz}{c}$: which equation reduced will be $\frac{psc}{rr} = z$. but by the former Lemma $\frac{2sc}{r}$ is equal to the Sine of the double angle, whereof s is the Sine: wherefore it will be, as radius to the Sine of double the angle FGB, so

So is half the parameter, to the horozontal range or distance sought: and at the several elevations; the ranges are as the sines of the double angles of elevation. Q. E. D.

Coroll.) hence it follows, that half the parameter is the greatest random, & that that happens at the elevation of 45° the sine of whose double is radius. Also that the ranges above or below equally distant from 45° degrees are equal, as are the sines of all doubled arches, to the sines of their doubled complements.

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2. The altitudes of projections made with the same velocity, at several elevations, are as the versed sines of the doubled angles of elevation.

As $c : s :: \frac{psc}{rr} = GB : \frac{pss}{rr} = BF$. and $VK = KV = \frac{1}{4}BF$, the altitude of the projection $= \frac{pss}{4rr}$. now by the foregoing Lemma $\frac{2ss}{r}$ = to the versed sine of the double angle; and therefore it will be, as as radius to the versed sine of double the angle FGB, So is $\frac{1}{8}$ of the parameter to the height of the projection VK; and So those heights at several elevations are as the said versed sines. Q.E.D.

Coroll.) hence it is plain the greatest altitude of the perpendicular projection is a 4th of the parameter, or half the greatest horozontal range: the versed sine of 180 degrees being $= 2r$.

The lines GE, or times of the flight of a project cast with the same degree of velocity at different elevations, are as the sines of the elevations.

As $c : v :: \frac{psc}{vv} = GB$ (by the 1st prop.) $: \frac{ps}{v} = G$; that is, as radius to the sine of elevation so is the parameter to the line GF; so the lines GF are as the sines of elevation, and the times are proportional to those lines; wherefore the times are as the sines of elevation. ergo conflat propositio.

Prob. I.

A projection being made, as you please, having the distance & altitude, or descent of an object, thro' which the project passes, together with the angle of elevation of the line of direction; to find the parameter & velocity; that is (having the angle FGB,) GM, and MX.

Solution.] As radius to the secant of FGB, so is GM the distance given to GL; and as radius to the tangent of FGB, so is GM to LM. Then LM — MX in heights, or + MX in descents: or else MX — LM, if the direction be below the horizontal line, is the fall in the time that the direct impulse given in G, would have carried the project from G to L = LX = GY: then by reason of the parabola; as LX or GY

GY is to GL or YX; So is GL to the parameter Sought: to find the velocity of the impulse, find the time in Seconds that a body would fall the Space LX, and by that dividing the line GL, the quote will be the velocity or Space moved in a Second, Sought, which is alway a mean proportional between the parameter and 16 feet, one inch.

Problem. II.

Having the parameter, horizontal distance and height or descent of an object: to find the elevations of the lines of direction necessary to hit the given object; that is having GM, MX, and the greatest random equal to half the parameter; to find the angles FGB.

Let the tangent of the angle Sought = t, the Horizontal distance GM = b, the altitude of the object MX = h, the parameter = p, and radius = r; and it will be, as $r : t :: b : \frac{tb}{r} = ML$; and $\frac{tb}{r} \mp h \left\{ \begin{matrix} \text{in ascents} \\ \text{in descents} \end{matrix} \right\} = LX$, and $\frac{ptb}{r} \mp ph =$ GLq. = XYq. ratione parabolæ;; but $bb + \frac{ttbb}{rr} = GLq.$ (by 47th of 1st Euclid) wherefore $\frac{ptb}{r} \mp ph = bb + \frac{ttbb}{rr}$; which equation transposed, is $\frac{ttbb}{rr} = \frac{ptb}{r} \mp ph - bb$; which divided by bb, is $\frac{tt}{rr} = \frac{pt}{br} \mp \frac{ph}{bb} - 1$. this equation Shews the question to have two answers, and the roots thereof are $\frac{t}{r} =$

$= \frac{p}{2b} \mp \frac{\sqrt{pp \mp 4ph}}{4bb} - 1$; from which I derive the following rule. Divide half the parameter by the horizontal distance, and keep the quote, viz. $\frac{p}{2b}$; then say, as the Square of the distance given, to half the parameter so is half the

parameter $\left\{\begin{matrix}-\\+\end{matrix}\right\}$ double $\left\{\begin{matrix}\text{height}\\\text{descent}\end{matrix}\right\}$ to the Square of a Secant $= \frac{pp \mp 4ph}{4bb}$, the tangent answering to that Secant will be $\frac{\sqrt{pp \mp 4ph}}{4bb} - 1$ or vr: So then the Sum and difference of the afore-found quote & this tangent, will be the root of the equation, & the tangents of the elevation sought.

Note here, that in descents, if the tangent exceed the quote, as it doth when ph is more than $-bb$, the direction of the lower elevation will be below the horizon; and if $ph = bb$, it must be directed horizontal and the tangent of the uper elevation will be $\frac{pr}{b}$: Note likewise, that if $4bb + 4ph$ in ascents, or $4bb - 4ph$ in descents, be equal to pp, there is but one elevation that can hit the object and its tangent is $\frac{pr}{2b}$; and if $4bb + 4ph$ in ascents, and $4bb - 4ph$ in descents, do exceed pp, the object is without the reach of a project cast with that velocity, and so the thing impossible.

Antimony, a mineral Subftance of a metal-
line Nature, having all the Seeming Characters
of a real metal, except Malleability; So
that tis what is called a Semimetal, being
a foffil Glebe, compofed of Some undetermined
metal combined with a Sulphurious and Stony
Subftance. It is found in mines of all metals,
but Chiefly thofe of Silver & Lead, That in
gold mines is eftemed the beft. There are
mines of it only in Hungary, Germany, &c.
Tis Sometimes called Marchafite of Lead, from
its being found in Clods or lumps refembling
black Lead, only tis both harder & lighter. Its
Texture is particular, being full of little Shining
veins, and brittle as glafs. Sometimes the veins
are of a red or gold colour intermixed, which is
called the Male & the other the female. It
fufes with Some difficulty in the fire and
diffolves in water; when dug out of the earth
it is fufed in a very ftrong fire, & then poured
into cones called Antimonial Horns, which
is the common Sort ufually Sold in the Shops.

Its ufes are very numerous, being a valu-
able ingredient in Specula, or concave burn-
ing Glaffes, rendering them of a finer polifh
than they would otherwife have: in Bell me-
tall it makes the tone or Sound clear, tis
mixt with tin to make it hard & white, and
with lead to make printers metal, to caft
or found their letters. In Phyfick its ufes
are So various, according to its preparation,
that Mr. Boyle Says, it alone, or in company
with one or two affociates; tis Sufficient to
furnifh an apothecaries Shop.

To find all the whole numbers a & b, that are Capable of producing this Equation $8a+97=5b$. Or this

$601a+9=200b$.

$\frac{601a+9}{200}=b=$ integ.

$\frac{a+9}{200}=$ integro

hence a may = 191 or 391, or 591, &c.

$8a+97=5b$

$\frac{8a+97}{5}=b=$ integ.

$\frac{3a+2}{5}=c=$ integ.

$5c=3a+2$

$\frac{5c-2}{3}=a=$ integ.

$\frac{2c-2}{3}=$ integro $=d$

$2c-2=3d$

$\frac{3d+2}{2}=c=$ integro

$\frac{d}{2}=$ integro, hence

d may = any even number. & $2\frac{1}{2}d+1=a$

Gallileo found, a copper wire, and of consequence any other Cylinder of copper, would sustain its own weight (hung up by one end) to the length of 4801 fathoms of six foot each.

The method of Silvering Looking-glass

When the plates are polished, a thin blotting paper is laid on a table & sprinkled with fine chalk; and this done, over the paper is laid a thin laminu, or leaf of tin on which is powred mercury, which is to be equaly distributed over the leaf with a hare's foot or cotton. Over the leaf is laid a clean paper and over that ~~another paper~~ the glass plate. With the left hand the glass is pressed down and with the right the paper is gently drawn out. which done the plate is covered with a thicker paper and loaden with a greater weight, that the Superfluous mercury may be driven out and the tin adhere more closely to the glass. When it is dried, the weight is removed & the glass is compleat.

Mercury, in the Torricellian Tube is ordinarily Suftain'd at the height of 28 or 29 inches, yet M. Hugens has found, that mercury well purged and in a close Still place, will be Suftain'd to the height of 72 inches: which is a Phanomenon all the philosophers are at a loss to account for. it adheres to the glass at the top

To Solder Gold & iron together, put a very little copper between them.

The Method of making Starch of Wheat.

The best Sort.

The Grain being well cleaned, is put to ferment in vessels full of water, which they expose to the Sun when in its greatest heat. changing the water twice a day for the Space of 8 or 12 days, according to the Season. When the grain bursts easily under the finger, they judge it sufficiently fermented. The fermentation perfected, and the grain thus softened; tis put handfull by handfull in a canvas bag, to Separate the flower from the husks, which is done by rubbing & beating it on a plank, laid acro the mouth of the emty vessel that is to receive the flower.

As the vessels are fill'd with this liquid flower, there is seen Swiming a top, a reddish water, which is to be carefully Scummed off from time to time, and clean water put in its place; which after Stirring all together is all to be Strain'd thro a cloth or Sieve, and wt is left behind, put into the vessel with new water, and exposed to the Sun for some time; and as the Sediment thickens at the bottom, they drain off the water four or five times, by inclining the vessel but without passing it thro the Sive. What remains at bottom, is the Starch, which they cut in pieces to get out, and dry it in the Sun.

Superfetation, is when a woman already pregnant, conceives of a later coition. tis frequent in hares & Rats. Bartholin tells us, of a girl born big with child. an extraordinary Superfetation Menzelius, a German Physitian, adds, that in 1672, the wife of a Physician, in Thuringia, was deliver'd of a girl big with a nother; whereof She was delivered in 8 days time; and which was baptized, and died a day after her mother! The Naturalists hold, that female rats are frequently born with young rats in their wombs.

In the History of the Royal Academy of Sciences, for the year 1709, mention is made of a letter from a very considerable magistrate, to the Academy, containing a very remarkable instance of a Superfetation; A Butchers wife of Aix being delivered that year of Nine children, each about two days after other, all well form'd & alive.

In a Tabes Dorsalis which proceeds from an excessive application to Venery, the patient has neither a Fever, nor loss of Appetite; but a Sensation, as if there were a Number of Spirits running from the head, down the Spinal marrow: and when he evacuates, either by urine, or Stool, there flows a liquid matter like Semen.

After any violent Exercise his head is heavy, and his ears tingle; and at length he dies of a Lipiria, i.e. a Fever, where the external parts are cold, and the internal burn at the same time.

Anno Mundi

688 Methuselah born.
930 Adam dies
1636 Methuselah dies
1657 The flood begins. Noah Aged 600.
2009 Abram born
2158 Shem dies Aged 600.
2169 Jacob born
2183 Abram dies
2288 Isaac dies Aged 180.
2315 Jacob dies
2434 Moses born.
2514 Hebrews leave Egypt.
2553 Moses dies
2990 Solomon begins to Reign
3101 Homer born.

A report of the Sworn Matrons of Paris,

We Mary Miran, Christophletta Keine, and Jeanne Porte Poulet, Sworn Matrons of the Cyty of Paris, certify to all those whom it may concern that on the 22 of October, in this present year, at the appointment of Monsieur the Provost of Paris, we went into the Street de Pompierre to the house next the Sign of the Silver key: to view & visit Olive Jefferane of the age of 30 years on a complaint made by her in court against James Mudont, Citizen of Roche Sur Mer; for forcing & violating her the said Olive: And having view'd & examin'd the whole with the eye & finger, we find,

Les Toutons devoyez, that is, the breasts loose & flaccid, Mamma marcida & flaccida: Les Barres froissees, i.e. the Os pubis bruised, Os pubis collisum: Le lippion recoquille i.e. the hair curl'd up, Pubes in orbem sinuata: L'Entrepet vidé i.e. the Perinæum or Seam wrinkled, Perinæum corrugatum: Le Pouvant debiffee i.e. the vulva or pudendum tumbled & disordered, vulva dissoluta & marcescens: Les Baluaux

pen

pendants, i.e. the lips hanging down Labia pendentia: Le lippenedis pile i.e. the edge of the lips bared of hair Labiorum ora pilis defecta: Les Babolles abbatues, i.e. the Nymphæ beat down, Nymphæ depressæ: Les Haleron demis, i.e. the caruncula undone or opened, caruncula dissoluta: l'Entrechenat retourné, i.e. the membranes which connect the caruncles inverted; membrana connectens inversa: Le Barbadoes ecorché, that is the clitoris excoriated, clitoris excoriata: Le Guilboquet fendu, i.e. the neck of the womb torn, collum uteri dilaceratum: Le Guilbenaxe elargi, i.e. the vagina stretched or widened; vagina dilatata: la Dame du Milieu retirée, i.e. the Hymen broke & gone, Hymen deductum l'arriere fosse ouverte, i.e. the inner orifice of the womb opened, Os internum matricis apertum: ——

The whole viewed & examined part by part, we find plainly the track or or footstep of — Accordingly we, the Sd Matrons, do certifie it to be true to you, Monsieur le Provost, on the oath we have taken. Done a Paris the 23d of October, 1672.

Dyches & Pardons English Dictionary.

Nitre now commonly called Salt petre, is a Salt of a bitterish taste, of which there are three Sorts; the first is a lixivium taken from the earth the Second grows upon Stone walls and the third upon rocks: it is impregnated with abundance of Spirits out of the air, which renders it volatile; Some of it is also found in Cellars and other moist places, occasioned by the condensation of the air in those places; Sometimes it is extracted from the urine of animals falling upon the ground or Stones, as in Stables. The native nitre of Alexandria and Naples is inclining to a rose colour, but that of Puzzuls is yellowish. The transparenter it is, the purer, and that which contains the least common Salt is the best which is easily tried by throwing a little upon burning coals, to see whether it consumes wholly, or leaves any visible part behind it.

ant Chr.	A. mundi	
290	3714	Archimedes born, lives 79 y.
276	3728	the bible translated into Greek
259	3745	Berosus, being old, writes.
183	3821	Scipio Africanus D. age 52.
106	3898	Cicero born, lives 64 y.
99	3905	Julius Cesar born, lives 56
69	3935	Virgil born, lives 52.
64	3940	Horace born, lives 57.
62	3942	Octavius born, lives 76
61	3943	Diodorus Siculus flourishes
58	3946	Livy born, lives 76 y.
54	3950	Aug. 26 Cesar 1st lands in Britain
42	3962	Ovid born, lives 59 y.
06	3998	Dionysius Halicarnassus writes
4	4000	John Baptist & Christ born
	4004	the last year before the vulgar Christian Era.

Surratte.

In a village near Arcadabat called Chirchees in the east Indies is the best indigo made. The herb like that of a yellow parsnip, but somewhat shorter and more bitter; it sprouts forth into branches like a reed, and rises sometimes 6 or 7 foot high, its flower is like that of a thistle, and the seed like fenugreed; the sow it in june, & cut it in Nov. or Decem. it is sown out once in 3 years; the first year they cut off the leaves within a foot of the ground; and after they have cut them from the stalk, dry them in y^e sun & afterwards lay them a soaking in a stone trough which has six or 4 foot of water in it stirring it very often till the water has sufficiently extracted all the colour & virtue of the herb. then they draw the water off into another vessel, which being well settled all night they take it off next day, and the settlement on the bottom is strained through a course cloth & dryed in the sun. This is the best indigo, ~~other~~. The stalks left the first year, produce leaves the next but these are not to be compared in goodness to those of the first, tho' they exceed those of the wild indigo. The best indigo will swim in water is inclining to a violet colour & has somewhat of that smell, when burnt. Harris's collec. voyages.

There is a great deal of Salt-petre vented at Suratte, which is made at Ajmer 60 leagues from Agra, out of the fattest ground after it has lain long fallow; they dig certain trenches, which after they have filled with Salt earth, they let in as much water as is Sufficient to reduce it to the consistence of broath & to Soak it the better they frequently tread it with their feet; when they judge the water has dissolved all the Saline Substance that was in the earth, they draw up the water into another trench, wherein Some time it thickens, when they boil it like Salt, Scumming it continually; and after-ward put it into earthen pots; where the dregs being Setled to the bottom, they take it out again & dry it to a hard Substance in the Sun.

The opium which comes from the Province of Gualor in Indostan, & is vented all over the Indies, is only the coagulated Juce of poppy, which is gathered by making an incision therein when it begins to be ripe

The king of Decan has greater Store of great Artillery than any of the Indian princes; & among the rest one brass cannon, the ball whereof weighed 800 weight, & required 540 pound of fine powder. The caster of it was an Italian. Harris coll of voyages Vol. ii Page 137.

The people of Formosa, instead of wine, make a certain mixture of Rice which being Soaked in warm water, they beat in a mortar to a paste; this they mix with Rice meal Chaw'd instead of Leaven; and having put it in an earthen Vessel, fill it up with water; which after it has fermented & Stood 2 months affords a very pleasant Liquor

Pulvis Fulminans.

℞. Salt of ☉ Tartar one part, of Common Brimstone two parts, Salt Petre three parts. Harris Vol. 2d page 561

Diabolus in Carcere.

Balsamus Lucatelli

℞ yellow wax oil olive and venice turpentine ā ā ℔ss. make into an unguent S. A.

The Same Gentleman also introduced us to a place where we saw the whole manner of making Venice Soap, which is accounted as good as Castile Soap. The whole Compofition is made of Oil of Olives, and a Certain Lee: The laft they make thus, Take of the afhes of the herb Kali known in England by the name of Beriglia, two thirds; of Kelp, i.e. the afhes of the ordinary Sea-wrack one third; thefe being beaten by a mallet into Small pieces, and well Mingled, are grinded to powder in a mill, not unlike our Cyder mills, and being Sifted afterwards, they mix Some Slacked Lime with the powder, and make it up into Pellets, which they put into Troughs, and pounding Sea-water upon it (freft water does as well) make the Lixivium or Lee. The Chaulerons wherein they boil their Soap are very Large, the bottoms of Copper, but the Side made of Stone, bound about with Iron hoops, and enclofed in a wooden Cafe. One third part of thofe Chauldrons they fill with Oil, and the remaining part with Lee, then putting fire under it, let it boil continually till the Oil be all boiled away, Still filling up the defect of the Lee as it boils away; by which means part of the Oil uniting it Self with the

the Salt of the Lee, rises up to the top in the form of a Scum, which condensing by the coolness of the air, produces that which we call Soap. The trial they make of the Strength of the Lixivium is, when an Egg will Swim in it. The cruy or Soap they take from the Surface of the Liquor, the Spread upon a floor, whereon Lime dust is Strowed (to hinder the Soap from Sticking to it) then Smooth it, and let it dry in a bed of about the thickness of a good brick. This when dry'd, they cut in lesser pieces, and having Cleans'd them by paring the adhering Impuritys, Seal them with a Seal.

N. B. That Beriglia alone would make too Soft, as the Kelp alone would render it too brittle. The green Colour (of which the Germans are very fond) is given it by putting a certain Quantity of juice of Beet into the Chauldron, with the oil and Lee. Harris. Collec. Voyag. Vol. 2. pa. 561.

The Persian ink is made of Galls & Charcoal, pounded together with Soot, Har. V. 2 page 338.

They whiten tin, brass & copper, with Sal-Armoniac purify'd, & Reduced to a white powder, which mingling with melted tin, they rub it on the Vessel with cotton, all over. Har. V. 2. p. 338.

Refining of Salt Petre.

The Salt being put in an earthen or iron vessel, as much Spring water is pour'd on it as Suffices to dissolve it. The vessel is then put over a gentle fire; and as soon as the water begins to boil, alom powder is thrown into it; the proportion is one pound of alom to 128 pound of Salt-Petre; and a little vinegar is added: as it boils the Scum is to be taken off.

Chamber's Dictionary Vol. 2. Refin.

Since the image is projected to the greater distance, the nearer another Lens of a ~~Globe~~ ~~Sphere~~ Segment of a larger Sphere is brought to the object Glass; a Microscope may be compos'd of three Lens's which will Magnify prodigiously.

Chamber's Dictionary, Vol. 2.

Compositions for concave Specula.

℞ Copper P. viii. Tin P. i.
Marchasite P. v.
Or
℞ Copper P. x. Tin iv. a little Antimony and Sal Armoniac. Stirring them about when Melting, as long as any fumes arise.

Chamber's Dictionary.

If a be put for any Annuity, p for the present value, x for the amount of one pound for one year at any given rate, and n for the number of years. Then

because $x:1::a:\frac{a}{x}$ the present value at the first years end

And, $x:1::\frac{a}{x}:\frac{a}{x^2}$ the present value at 2d years end.

And, $x:1::\frac{a}{x^2}:\frac{a}{x^3}$ the present value at 3d years end.

&c.

Then $\frac{a}{x}+\frac{a}{x^2}+\frac{a}{x^3}+\frac{a}{x^4}+\frac{a}{x^5}+$ &c to $\frac{a}{x^n}$ will be the present value equal to p.

But $\frac{a}{x}:\frac{a}{x^2}$ or as $x:1::p-\frac{a}{x^n}:p-\frac{a}{x}$

Therefore, $p-\frac{a}{x^n}=px-a$

And, $px-p=a-\frac{a}{x^n}$

And, $p=\frac{a-\frac{a}{x^n}}{x-1}$

To find the present value of an Annuity of 50£. per Ann. to continue for 90 years at the rate of 5 per cent, per Ann.

here $a=50$ $n=90$ & $x=1,05$

Now in order to obtain the Answer, we must find the 90th power of x, or of 1,05: the Log. of 105 is, 0211893 which multiplied by 90 the product is 19070370 which is the Log. of the 90th power of 1,05 which Subtracted from 1,6989706 the Log. of 50 or a, will leave 9.7918330 the Log. of

of .619203, which being Subftractee from 50, & divided by $x-1=,05$ will give 987,61594 equal to 987£. 12 S. 3d. $\frac{3}{4}$ for the prefent value of the Annuity, Sufficiently exact.

In Circulo

$\dot{c}:\dot{y}::t:y$ & let $r=1$ $\sqrt{1-y^2}:y::r:t$

ergo $\dot{c}=\frac{t\dot{y}}{y}$ ergo $t=\frac{y}{\sqrt{1-y^2}}$

and $\dot{c}=\frac{t\dot{y}}{y}\times\frac{y}{\sqrt{1-y^2}}$

and $\dot{c}=\frac{\dot{y}}{\sqrt{1-y^2}}$

Let S=Secant

then $r-x:r::r:\frac{r^2}{r-x}=S=\frac{r=1}{1-x}$

$\sqrt{t^2+r^2}=\sqrt{t^2+1}=S=\frac{1}{1-x}=\frac{1}{\sqrt{1-y^2}}$

$\sqrt{t^2+1}=\frac{1}{\sqrt{1-y^2}}$ and $t^2+1=\frac{1}{1-y^2}$ & $1-y^2=\frac{1}{t^2+1}$

ergo $-y\dot{y}=\frac{-t\dot{t}}{t^2+1}$ & $y\dot{y}=\frac{t\dot{t}}{t^2+1}$ $y^2=1-\frac{1}{t^2+1}$

Now $\dot{c}=\frac{t\dot{y}}{y}=\frac{t\dot{y}\dot{y}}{y^2}$ $y=\sqrt{1-\frac{1}{t^2+1}}$

$y=\sqrt{\frac{t^2}{t^2+1}}=\frac{t}{\sqrt{t^2+1}}$

and $\frac{t\dot{y}}{y^2}=\frac{\frac{t\dot{t}}{t^2+1}}{\frac{t^2}{t^2+1}}=\frac{t\dot{t}}{t^2}=\dot{c}$

ergo $\frac{\dot{c}t^2}{t^2+1}=\frac{-t^2\dot{t}}{-t^2+1^2}$ & $\dot{c}t^2\times(t^2+1)^{-2}=\dot{t}\times\sqrt{t^2+1}$

and $\dot{c}\times(t^2+1)^{-2}=\dot{t}\sqrt{t^2+1}$ $\dot{c}=\frac{\dot{t}\sqrt{t^2+1}}{t^2+1}$

$\dot{c}=\frac{t\dot{y}}{y}=\frac{ty\dot{y}}{y^2}=\frac{t^2\dot{t}}{\frac{t^2}{t^2+1}}=\dot{c}$

ergo $\frac{\dot{c}t^2}{t^2+1}=\frac{t^2\dot{t}}{t^2+1}$ & $\dot{c}t^2=\frac{t^2\dot{t}}{t^2+1}$ & $\dot{c}=\frac{\dot{t}}{t^2+1}$

A French Man told me, that, their way of Making Salt-petre in France is, Thus,

They take Casks or boxes of the bignes of half a barrel, into which they put first at the bottom half a bushel of old Wall powdered, next a peck of Lime, then half a bushel of wood ashes; to which they putt water & let it Soak 5 or Six weeks, and then draw off the Lye, and boil it to get the Salt and one tub of the wall, ashes &c. he Says will afford almost a peck of Salt.

Doct. Forden Saith, Our Salt-petre men find, that when they have extracted Salt-petre out of a floor of earth one year, within three or four years after, they find more Salt petre generated there, and do work it over again. And to confirm this we know certainly that in many places of this Nation where persons make a king of trade to draw forth Salt petre, they keep earth (fit for that purpose) in cellars, where once in three or four years (tho' formerly all the Salt-petre had been extracted) it will renew it self and be fully impregnated with more Salt petre; Webster's History of Metalls p. 43.

The Method of tanning Oxes, Cows, Calves or Horses hides.

The Tanner begins with taking of the horns ears & the tail, after which tis ~~drawn~~ thrown into a running water for about thirty hours to wash off the blood and other impuritys adhering to the inside. This done, tis laid over night in a lime pit already used, whence it is taken and left to drain three or 4 days on the edge of the pit. This short and slighty preparation over, it is turned into a strong lime pit for two days, then taken out for four more, and thus for Six weeks alternately taken out & put in twice a week.

At the 6 weeks end, it is put into a fresh pit, where it continues eight days, and is taken out for so many; and thus alternately for a year or eighteen months according to the Strength of the Leather, or the weather, for in heats they put in fresh ~~[illegible]~~ lime twice a week, and in frost they dont touch them, Sometimes for three months. Every fresh lime pit they throw them into is Stronger & Stronger: At four or five or Six weeks end the tanner Scrapes off the hair on a wooden log or horse with a kind of knife for that purpose.

And after a year or eighteen months when the hair is perfectly gone, he carries it to a river to wash, paves of the flesh on the leg with a ~~[illegible]~~ kind of a cutting knife, and rubs it briskly with a kind of whet Stone to take off any remains of flesh, or filth on the Side of the hair.

The Skin is now put into Tan, that is, covered over with tan as tis Stretched in the pit, and wate

water let in upon it. If the Skin be Strong, five coverings of tan will be requir'd; for weaker, three or four may Suffice.

When the Skin has not been kept long enough in lime or the tan pit, upon clegving it in the middle is seen a whitish Streak called the horn, or crudity of the Skin; & tis this is the reason why the Soles of Shoes boots &c. Stretch So eafily and take water.

When the hides are Sufficiently tann'd they are taken out of the pit to be dry'd by hanging in the air. Then the tann is clean'd off them and they are put in a place neither too dry nor too moift, they are well Stretched on another wide at top to keep them tight and Strait: and in that condition are Sold unde the denomenation of Bend Leather.

This is the Method of tanning bullock's or oxen hides.

Cows, calves or horfes hides, are only kept four months in the lime pit; and that before they are put in the tan, there is a preparation required, thus, cold water is put into a wooden fat or tub, wherein the Skins are put, which are kept Stirring while Some other water is warming in a kettle, and as Soon as that water is a little more than luke warm, tis powr'd gently into the fat, and thence is caft a basket or tan therein, which tone the Skins are Still kept Stirring & turning that the water & tan may not burn them: after an hour they are taken out, and caft for a day in cold water, then returned into the former fat, & the Same water they had been in before, and here they are left eight days, which expir'd they are put in the tan pit, and three coverings of tan given them, the first of which lafts five weeks the 2d Six, the 3d two months.

℞. any volatile animal Salt ℔ß. put to it Spt. Vin. tartarisat. ℔ß. and it will Coagulate, & is what Helmont Calls Offa Albæ. put this Salt into a Matrass, pour upon it pure & strong distilled vinegar, by little & little at a time till the Ebullition ceases; then Set it in a gentle heat of Sand with the head & receiver well luted. there will first come over a Subtile liquor dropping from the nose of the alembick, after that, will Sublime into the head, a most glorious Salt white as Snow, in figure like large flowers of Benjamin, of a pleasant penetrating Scent & taste.
As Soon as the crystals begin to give in the head, the Operation must be immediately ended & the Spt & Salt put apart into vials well Stopt

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Mix Salt of tartar ℥iv with Cream of tartar ℥viii & pulverise them together put them into an earthen pan, into which pour of Spring water ℔iij. boil them till they are diffolv'd & remember now & then to Stir them, filter the diffolution whilst warm, evaporate to dryness, & keep in a glass close Stopt. It works by urine & Stool. its dose from ℈j to ℥ij

Laudanum Liquidum Sydenhami.

℞ Opii ℥ij. Cinnamomi
Croci ℥j. Cariophillorum ãa ℥j

Digere Baln. Max. per Biduum in. vini Hyspan. ℥xvi. & cola. Dos. a 10 ad 30 gut.

Laud. Liquid. Tartarisatum.

℞ Opii ℥ij Cariophyll. ℥j
Croci ℥j Macis ℥j
Cinnam. ℥j Nuc. Mosc. ℥j
Xylo Aloes ℥j
Tinct. Sal. Tartar. ℔ij.

Digere per Biduum, filtra, & exhala ad partem dimidiam.

Pulvis Comitis Warwicensis.

℞. Scammonii Sulph. ℥ij.
Antim. Diaphor. ℥j.
Crem. Tartar. —— ℥fs.

Pulv. Basilicus

℞. Diagridii
Cerussæ Antim.
Crem. Tartari
Mercur. Dulcis ãa p. e.

Balf. Anod.

℞ Caſtil. Soap. ℥ſs. Opium ℥¼ Camph ℥⅜
Oleum Anif. ℥ſs ℞. S. V. ℥ix.

Elix. Vitriol.

℞. Cinn. Ging. & Cloves āā ℥iſs. Cal. Aron ℥ſs. Galang. ℥vi. Cubebs & N.M. āā ℥j. Sag & Mint dry'd āā ℥ij. wood of Aloes & Citron peel āā ℥ſs. white Sugar Candy ℥iſs Spt. Vin ℥Xii. Oleum Vitriol. ℥viii.

Turner's Cerate

℞: May butter unſalted & yellow wax āā lb.iijſs. Ol. oliv. lb.iv Calamine cleanſed & levigated ℥Xii. Melt the butter & wax with the oil and ſtir in the Calamine till it is too hard to let it ſettle. x wather lbij

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Sternutatorium
Cum Turpetho Minerali.

℞ Turpeth. Mineral. ℥ſs. D.r Quincy.
Pulv. Glycirrhiz. ℥ſs.
Nucis Moſch. ℥j
Ole. Anthus gut. ij. Miſce.

Doct. Towne ſaith, in the dry belly-ach, after the patient begins to diſcharge by ſtool, tis beſt to give him every ſix hours two ſcruples of Balſ. Peru in a little loaf ſugar, or in its ſtead give two drachms of Barbadoes tarr three times a day, till the diſeaſe be quite gone. when there is danger of a paraliſis, chafe the whole length of the perſon with this tarr in double diſtilled rum, as alſo the limbs.

Doct Hull's Medicinal Arcanum for the dry belly-Ach.

℞. Angelica, The Root of unicorns horn ℥j āā p. E. Misce f. P with a little loaf Sugar dose 40 gr. to be given first, as a carminative & antiemetic.

His purge

℞. Ginger, Mace, Cinnamon, Saffron, Cloves & Myrrh āā p.e. of Aloes as much as all the reft. to be given 30, or 40 gr. at a dose & repeated every two or three hours as there is need till it operates. which Sometimes it will not till the patient has taken 30 doses.

Capt Crispin's pills.

℞. Suc: Glyc. inspiſ. ℥ij Balſ. Tolut. ℥ſs Extr. Thebai. gr. VI. misc. f. Maſs. pillul. Singul. Pil. gr. IV. in Tuffim. Pilul 3 pro Doſ. hor. Somn.

Balſ. Anod.

℞. Sap. Venet. ℥j Opium ℥ſs Camph. gr. 40 Saffr. gr. 20. Spt. Vini R. ℥ij. Dos 40 or 50 g

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Cancer Ungu. given me by Doct Walter.

℞. Hog Brake Seed two parts, the knob at the root of a Sort of plantane one part, Freſh butter quant. Suffic.

Pill. Anod. given me by Doct Walter.

℞ Camph. ℥ij Caſtor. ℥ij Sal. prunel. ℥iſſ Syr. Frid. facie. q.S. Miſc. f. pilul. Dos gr. 20.

Elixir Aſthmat.

℞. honey & Liquorif. āā ℥ij. Flor. Benz. & opium āā gr. 30 Camph. gr. 20. oleum Anif gr. 20 Sal. Tart. ℥j S. V. R. lib. j Dos 20, 30, or even 40 or 100 gut.

Dyche's Dictionary.

Malt, The grain called Barley prepared as follows; Steep a quantity of barley so long in water till it is of a bright reddish colour, which is best done in cool weather, Summer not being a fit Season & winter too cold: when tis Sufficiently Steep'd, the grain will be very much Swelled and soft, then take it out of the Steeping trough and lay it on heaps to drain, after this Spread it till it is about 20 or 24 inches thick the whole difficulty lies in managing this floor, which in about 15 hours time will begin to put forth the root, which must be carefully kept turning, or it will become blade, which is carefully to be avoided; this done throw it into a heap as high as you can and let it remain so, till it grows so hot in the middle that you can scarce bear to thrust your hand in; then throw or Spread it abroad again to cool, and then Spread it upon a hair cloth or wire upon a kiln, with having a moderate fire that will last about 24 hours, let it dry, and afterwards another Slower, and if occasion requires, a third, otherwise it will not grind well, nor will the drink be either well-tasted, coloured or keep. Peat and Turf are reckoned the best fuel, and next to those Charcoal.

And the force of the fluid on the whole line DE is as the breadth of the fluid that falls on it which is as the Sine of the angle of incidence. Ergo The force of the fluid to move the line DE in the direction CH is as the product of the Sine & Cosine of the angle of incidence multiplied into the Sine of the angle of incidence. i.e. as the Square of the Sine into the Co-Sine. Q.E.I.

Now let DC=r DG=y the Sine of the arch but & let GC=z the co-Sine of the same arch. Then is the force of the fluid to move the line DE in the direction CH, as y^2z, now when this factum (y^2z) is greatest then is that force greatest.

y^2z

$2\dot{y}yz+\dot{z}y^2=0$ now $z^2=r^2-y^2$

$2z\dot{z}=-2y\dot{y}$

$\dot{z}=\frac{-y\dot{y}}{z}$

$2\dot{y}yz-\frac{y^3\dot{y}}{z}=0$

$2\dot{y}z-\frac{y^3}{z}=0$

$2yz^2=y^3$ $2z^2=y^2$ then if $r=1$

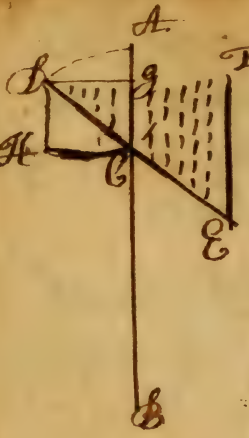
$2-y^2=y^2$ $2z^2=2-2y^2$

$2=3y^2$ $y=\sqrt{\frac{2}{3}}=,81649$

$z=\sqrt{\frac{1}{3}}=,57734$

y= to the Sine of 54° $44'$

Or thus



To find the angle of inclination (GCD) of the line DE to the line AB, so that a fluid moving in the direction AB against the line DE (which is immovable in the direction AB) shall have the greatest force to move the line DE in the direction GB.

The force of the fluid on one single point of the line DE is as the sine of the angle of incidence DG, and it is impress'd in a direction perpendicular to the line DE; and that perpendicular force, is (to move the line DE in the direction CH) as the sine of the angle of incidence which a line perpendicular to DE makes with DH, (CG) which angle of incidence, of the line perpendicular to DE, upon DH, is equall to the Complement of the angle GCD; therefore the force of the fluid on one single point of the line DE to move it in the direction CH is as the sine of the angle GCD multiplied by the sine of the angle GDC its complement.

And

In Every Parallelogram, the Sum of the Squares of the two Diagonals, is equal to the Sum of the Squares of the four Sides.

Chamber's Dictionary. all above from page 3d

N.	S.	C.	
100	20	24	canon weaker
100	25	25	canon Stronger
100	18	20	Musquet Stronger
×100	15	18	Musquet weaker
100	12	15	Pistol Stronger
100	10	18	Pistol Weaker

Miethius Says the Strongest that can possibly be made, is of Nitr. ℔j Coal ℥iij and Sulph. ℥ij ℈iij or ℥ij ¼

10 1 2 of Sawdust for white.

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the Specific Gravity

lead 443

off

Ol. Vitriol	76
Fermt. Spt. Nitr	72
Spt. Nitr. c. ol. vitr.	59
Aq. fort. Dupl.	55
Spt vitriol	49
Spt. Salt c. ol. vitr.	47
com. Spt. Salt.	42½
com. water	41
Spt. vini rectific	32
boild water	

The Quadrature of all curves comprehended under this general Equation $y = x\sqrt[m]{x+a}$

$$y = x \times \overline{x+a}^{\frac{1}{m}}$$
$$y\dot{x} = \dot{x} \times \overline{x+a}^{\frac{1}{m}}$$

To render the Element of the curve integrable; Suppose $\overline{x+a}^{\frac{1}{m}} = v$ then will $x+a = v^m$ & $\dot{x} = mv^{m-1}\dot{v}$

$$y\dot{x} = mv^m\dot{v}$$

$$\int y\dot{x} = \frac{mv^{m+1}}{m+1} = \frac{m\overline{x+a}\sqrt[m]{x+a}}{m+1}$$

Let $x = 0$ the remainder is $\frac{m}{m+1}a\sqrt[m]{a}$ whence the area of the curve is

$$\frac{m}{m+1}\overline{x+a}\sqrt[m]{x+a} - \frac{ma\sqrt[m]{a}}{m+1}$$

The Quadrature of Des Cartes' curve which is defined by this Equation,

$$\frac{b^2}{x^2} = \frac{b-x}{y}$$

$$b^2y = bx^2 - x^3$$
$$y = \frac{bx^2 - x^3}{b^2}$$

$$y\dot{x} = \frac{bx^2\dot{x} - x^3\dot{x}}{b^2}$$

$$\int y\dot{x} = \frac{x^3}{3b} - \frac{x^4}{4b^2}$$

The best Authors of Short-hand writing are Wilkins, Shelton, Wallis, Webster, and Weston.

A Cylinder of 48 ounces of Silver covered with a coat of gold only weighing one ounce, Dr. Halley informs us, is commonly drawn into a wire, 2 yards of which only weighs one grain: whence 98 yards of the wire only weigh 49 grains; and one Single grain of Gold covers the Said 98 yards So that the ten thousand part of a grain is above $\frac{1}{3}$ of an inch long. And he finds the thickness of the Skin of Gold to be only $\frac{1}{134500}$ part of an inch, yet So perfectly does it cover the Silver, that even a Microscope does not discover any appearance of Silver underneath.

Mr. Boyle relates, that 8 grains of Gold covering a Cylinder of Silver, is commonly drawn into a wire 13000 feet long.

This Series 1 1+3 1+3+5 1+3+5+7 &c is
$= 1. 4. 9. 16. 25. 36.$ &c. $= \frac{1+1}{2}\ \frac{2+6}{2}\ \frac{3+15}{2}\ \frac{4+28}{2}$:
$= \frac{1+2+3+4\text{ &c.} + 1\times1+2\times3+3\times5+4\times7\text{ &c}}{2}$

and $\frac{1}{2+1} = \frac{1}{3} = \frac{1}{2} - \frac{1}{4} + \frac{1}{8} - \frac{1}{16} + \frac{1}{32}$ &c.

and $\frac{1}{4} = \frac{1}{3+1} = \frac{1}{3} - \frac{1}{9} + \frac{1}{27} - \frac{1}{81} + \frac{1}{243}$ &c.

and $\frac{1}{5} = \frac{1}{4+1} = \frac{1}{4} - \frac{1}{16} + \frac{1}{64}$ &c.

$\frac{1}{1+2} = 1 - 2 + 4 - 8 + 16$ &c continually receeding from the quotient.

if the Series be Supposed to termi=nate in -8; then will

$\frac{1}{1+2} = 1 - 2 + 4 - 8 + \frac{16}{3}$

Suppose the general Series to termi=nate in $-c^3$; then will $\frac{1}{1+c} = 1 - c + c^2 - c^3 +$

$\frac{c^3}{1+c} = \frac{1+c-c^2+c^2+c^3-c^3-c^4+c^4}{1+c} = \frac{1}{1+c}$.

My Own invention.

This Series, $0 + \overline{0+1} + \overline{1+2} + \overline{3+3} + \overline{6+4} + \overline{10+5} + \overline{15+6}$ &c

is $= \frac{1+1}{2} + \frac{2+4}{2} + \frac{3+9}{2} + \frac{4+16}{2} + \frac{5+25}{2} + \frac{6+36}{2}$ &c

This $\frac{1}{2} + \frac{2}{4} + \frac{3}{8} + \frac{4}{16} + \frac{5}{32}$ &c. is equal to

$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}$ &c. $+ \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}$ &c. $+ \frac{1}{8} + \frac{1}{16} + \frac{1}{32}$ &c

$+ \frac{1}{16} + \frac{1}{32}$ &c. $+ \frac{1}{32}$ &c. $= \frac{1+1\times2+1\times2+1\times2+1\times}{32}$ &c.

continued to the Number of places in the first Series.

This Series $\frac{1}{2} + \frac{2}{4} + \frac{3}{8} + \frac{4}{16} + \frac{5}{32}$ &c. infinitely $= 2$.

for $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$ &c. infinitely $= 1$

& $\frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ &c infinitely $= \frac{1}{2}$

& $\frac{1}{8} + \frac{1}{16} + \frac{1}{32}$ &c. infinitely $= \frac{1}{4}$

Two Cannons for finding the courſe between two places.

I. As Radius to the co-Sine of the middle lattitude; So is the diff. of Longit. to the whole departure from the meridian in the courſe between the two places.

2. As Radius to the half Sum of the coſines of both the Latt. (or rather) as the diameter to the Sum of the coſines of both Latt. So is the difference of Longit. to the departure from the meridian

Of infinite Series.

Suppoſe a Series requered to expreſs the quotient of b divided by $a+c$. Divide the dividend by the diviſor, as in common Arithmetick; continuing the diviſion till the quotient Shew the order of the progreſſion. thus

$$\frac{b}{a+c} = \frac{b}{a} - \frac{bc}{a^2} + \frac{bc^2}{a^3} - \frac{bc^3}{a^4} \&c.$$

If $b=1$ and $a=1$ Subſtituting this value for that we have, $1-c+c^2-c^3+c^4 \&c.$

wherefore $\frac{1}{1+c} = 1-c+c^2-c^3+c^4 \&c.$

If an Isoceles triangle be moved in a fluid according to the direction of a line perpendicular to its base first with its vertex foremost, and then with its base; the resistances will be as the Legs, and as the Squa of the base, and as the Sum of the le

The resistance of a Square moved according to the direction of its Si and of its Side, is as the diagonal, the Side.

Sir Isaac Newton Shews, that if a Globe & a cylinder of equal diame ters, be moved with equal velocity in a thin medium, consisting of equal particles, disposed at equal distances, according to the direction of the axis of the cylinde the resistance of the globe will be less by half than that of the cylinder.

of the Radius to the sine of the Suns declination (South) when that sine is shortest.

To find the time of the moons begining to Shine.

Multiply her age, if under 15 days by 48, and divide the product by 60: the quotient gives the hours & the remainder the minutes. If her age be above 15 days, Subtract the time thus found from 24; the remainder gives the time of Shining in the morn.

To find the moons age,

To the day of the month add the Epact of the year, and the months from march inclusive. The Sum, if under 30; if over, the excess is the moons age. If the month have but 30 days, the excess above 29 is the moons age.

Chambers's Dictionary

The ordinary Stature of the inhabitants of this earth is Computed at 5 feet 4 inches $4\frac{3}{10}$ English.

Dr Ed. Halley in the Philosophical Transactions, n. 348. Saith the parallax of the Sun may be determined by Scientific Venus between the earth & Sun.

Ob legem autem motuum aemodum certas, raciissime intra Solis orbem conspicitur Venus ac per plus quam centum & viginti annorum Seriem ne Semel quidem ibidem videbitur; nempe ab anno 1630. (cum Horroxio nostro eique primo & Soli a verum a verum conditu, hoc Spectaculum obtigit,) usque in annum 1761, quo juxta theorias quas hactenus cælo conformes experimur, Stella Veneris iterum Subtercurret Solem, Maii 26 mane; ita ut Londini, horâ fere Sextâ matutinâ in medio disci Solaris expectanda Sit, nec nisi quatuor minutis centro Solis obstrabitur. Duratio autem hujus transitus erit octo fere horarum à Secunda Scilicet usque in decimam fere matutinam.

The Specifick weight of ye Several Metals.

Gold	19635	Iron	7852
Quicksilver	14019	Tin	7321
Lead	11341	Stone	2000
Silver	10513	Water	1000
Copper	8843	Air	$1\frac{3}{17}$
		or rather air	$1\frac{8}{17}\ \frac{3}{17}$

A Cubick inch of weighs

	ounces.	Drams.	grains.
Gold	12	2	52
Quicksilver	8	6	8
Lead	7	3	30
Silver	6	5	28
Copper	5	6	36
Iron	5	1	24
Tin	4	6	17

The Sealed Gallon at Guild Hall, which is the Standard for wines, Spirits &c.

Contains 224 cubick inches. Tho it is commonly Supposed to contain 231, after which the Smaller measures are made.

Beer Measure, 272½ cubick inches make one Gallon.

A Buffel contains 2178 cubick inches, equall to 8 beer gallons.

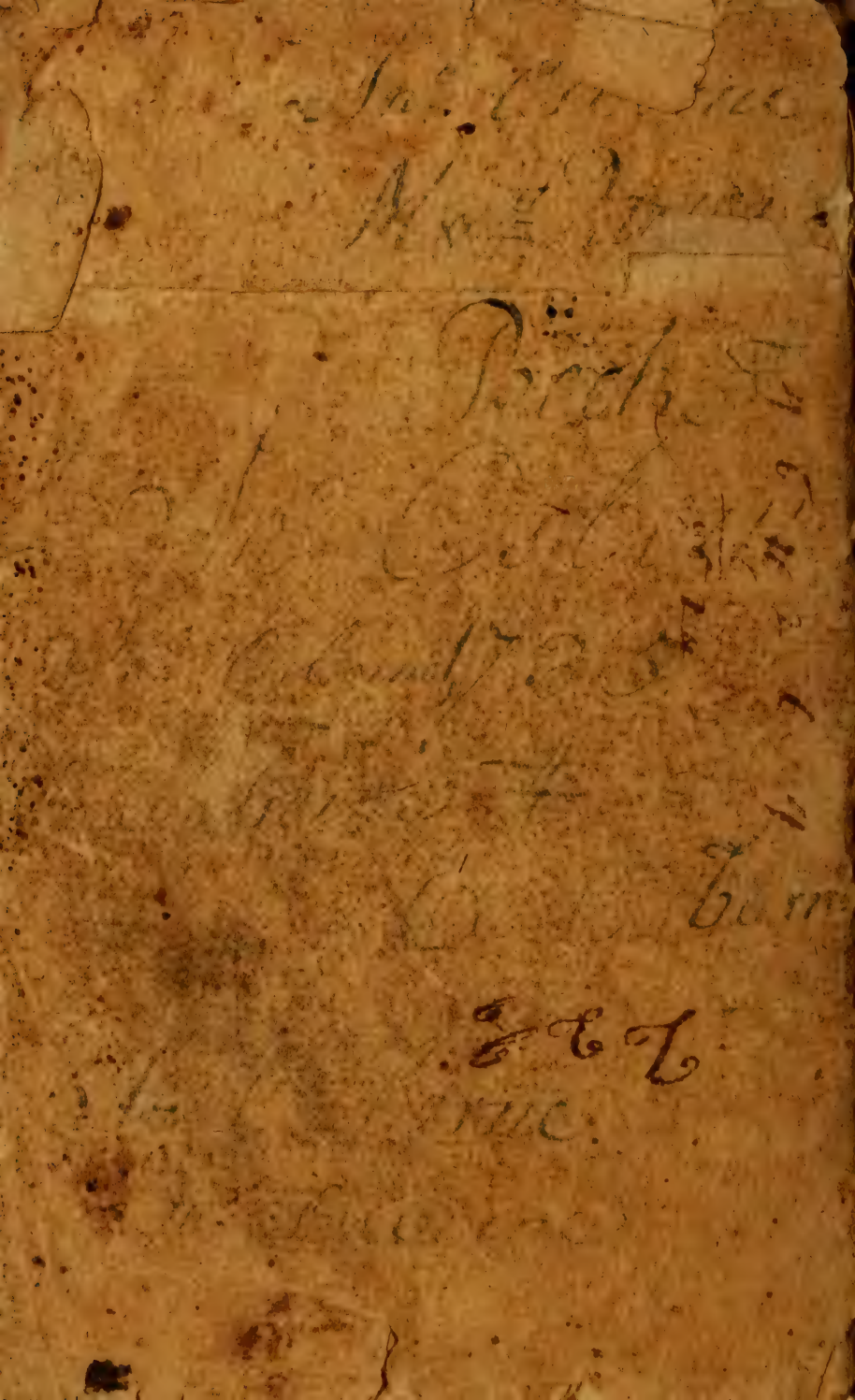
Anno Mundi	ante Christ	
3029	975	Solomon dies
3101	898	Homer born.
3252	742	Rome founded
3258	736	Sardanapalus dies.
3306	698	Hezekiah dies.
3364	640	Josiah begins to reign.
3365	639	Thales of Miletus born.
3366	638	Solon born in Salamis
3437	563	Pythagoras born. lives 80 y
3443	551	Nebuchadnezzar dies.
3466	538	Belshazzer Slain
3468	536	Darius dies. Cyrus reign
3485	519	Pindar born.
3518	486	Zoroaster appears at the
3521	473	Herodotus born (persian Cou
3534	470	Thucidides born
3536	468	Socrates born, lives 70 y
3540	464	Xerxes killed
3545	459	Democritus born & Soon after Hyppocrates.
3569	435	Isocrates born. lives 98 y
3574	427	Plato born. lives 80 y
3604	400	Ctesias taken Captive.
3621	383	Aristotle born, lives 63
3624	380	Demosthenes born.
3649	355	Alexander the great bo
3664	340	Epicurus born lives. 72 y

Mihi est propositum in Taberna mori,
Vinum sit appositum morientis ori:
Ut dicant, cum venerint, Angelorum chori,
Deus sit propitius huic potatori.

A Cubic foot of water weighs 70 lib. 3. 2

17 pounds Troy, is equal to 14 pounds averdupois.
80 ounces Averdupois are equal to 73 ounces Troy:
A Cubic foot of air weighs 1 oz. 3 gr. 27

Anno mundi	Anno Domini	
4029	25	Strabo dies
	46	Apollonius Tyaneus flourishes
	48	Quintius Curtius flourishes
	62	Persius the poet d. aged 29.
	65	Seneca & Lucan put to death
	70	Titus dest. roys Jerusalem
	77	Pliny flourishes
	82	Juvenal & Martial flourish
	85	Statius the poet flourishes
	94	Josephus finishes his Antiquit.
	95	Quintilian dies
	98	Tacitus writes
	119	Plutarch flourishes
	125	Ptolamy begins his observations
	127	Suetonius flourishes
	144	Justin the Histor. & Galen flour.
	148	Diogenes Laertius flourish.
	172	Epictetus flourishes
	230	Longinus writes



John Osborn fecit, October 1737

The top of a pole 6 feet high (The earth's diameter being 7969 miles) may be seen from the earths Surface 3 miles 48,9 feet.

But the earths diameter being 8000 miles, it may be seen 3 miles 79,8 feet.

A thing ten feet high may be seen 3 miles

$3\frac{3}{4}$ miles 25 rods & 9,8 feet

A thing 20 feet high may be seen $5\frac{1}{2}$ miles 75,4 feet.

A thing a mile high may be seen 89,4472.7

2 miles high may be seen 126,5607

3 miles high may be seen 154,945

10 miles high may be seen 283,0

20 miles high may be seen 400,49

100 miles high may be seen — 900,00000

200 miles high may be seen 1280,6

1000 miles high may be seen 3000,00000

2000 miles high may be seen 4472,1

half a mile high may be seen 63,2

a $\frac{1}{4}$ of a mile may be seen — 44,7

ll, only
e 5 foot
height sup-
ose the
iameter
8000

A Table of Meridional parts

	00′	30′		00′	30′
01°	60,0	90,0	31°	1958,1	1993,1
02°	120,0	150,1	32°	2028,4	2063,9
03°	180,1	210,1	33°	2099,6	2135,4
04°	240,2	270,3	34°	2171,5	2207,8
05°	300,4	330,5	35°	2244,3	2281,0
06°	360,7	390,8	36°	2318,0	2355,2
07°	421,1	451,3	37°	2392,7	2430,3
08°	481,6	511,9	38°	2468,3	2506,5
09°	542,2	572,0	39°	2545,0	2583,7
10°	603,1	633,5	40°	2622,7	2662,0
11°	664,1	694,7	41°	2701,6	2741,5
12°	725,3	756,1	42°	2781,7	2822,3
13°	786,8	817,6	43°	2863,1	2904,3
14°	848,5	879,6	44°	2945,8	2987,7
15°	910,5	941,5	45°	3030,0	3072,6
16°	972,8	1004,0	46°	3115,6	3159,0
17°	1035,3	1066,7	47°	3202,8	3246,9
18°	1098,2	1129,7	48°	3291,6	3336,6
19°	1161,5	1193,2	49°	3382,1	3428,1
20°	1225,1	1257,1	50°	3474,5	3521,4
21°	1289,2	1321,4	51°	3568,8	3616,8
22°	1353,7	1386,1	52°	3665,2	3714,2
23°	1418,7	1451,3	53°	3763,8	3813,9
24°	1484,1	1517,0	54°	3864,7	3916,0
25°	1550,0	1583,2	55°	3968,0	4020,6
26°	1616,5	1649,9	56°	4073,9	4127,9
27°	1683,6	1717,3	57°	4182,7	4238,1
28°	1751,2	1785,2	58°	4294,3	4351,3
29°	1819,5	1853,8	59°	4409,2	4467,0
30°	1888,4	1923,1	60°	4527,4	4587,8
			61	4649,3	4711,6
			62	4775,0	4839,4
			63	4905,0	4971,6

A Table of Meridional parts.

	00′	30′		00′	30′
64°	5039,5	5108,5	78°	7744,6	7891,8
65°	5178,8	5250,5	79°	8045,7	8206,2
66°	5323,6	5395,0	80°	8375,3	8552,3
67°	5474,0	5551,6	81°	8739,1	8936,2
68°	5630,9	5711,8	82°	9145,6	9368,1
69°	5794,6	5879,3	83°	9605,9	9861,3
70°	5966,0	6054,7	84°	10137,0	10436,6
71°	6145,7	6239,0	85°	10764,7	11127,4
72°	6334,9	6433,2	86°	11532,6	11992,0
73°	6534,5	6638,5	87°	12522,3	13149,3
74°	6745,7	6856,2	88°	13916,6	14905,8
75°	6970,3	7088,1	89°	16299,8	18682,5
76°	7210,1	7336,2	90°	89′59	30364,3
77°	7467,2	7603,1			

A Table of Refractions of the heavenly bodys, at the several degrees of altitude by M. de la Hire

Alt	Refrac.	Alt	Refr.	Alt	Refr.	Alt	Refr.
0	32′ 00″	13	4′ 25″	26	2′ 12″	39	1′ 24″
1	26 35	14	4 07	27	2 07	40	1 22
2	20 43	15	3 51	28	2 03	41	1 19
3	15 44	16	3 26	29	1 59	42	1 17
4	12 26	17	3 23	30	1 55	43	1 15
5	10 26	18	3 12	31	1 51	44	1 13
6	9 08	19	3 01	32	1 47	45	1 11
7	8 08	20	2 51	33	1 43	46	1 09
8	7 01	21	2 44	34	1 40	47	1 07
9	6 17	22	2 38	35	1 36	48	1 06
10	5 41	23	2 31	36	1 33	49	1 04
11	5 11	24	2 24	37	1 30	50	1 02
12	4 46	25	2 18	38	1 27	51	1 00

Alt	Refr.	Alt	Refr.	Alt	Refr.	Alt	Refr.
52	0′ 58″	62	0′ 39″	72	0′ 24″	82	0′ 10″
53	56	63	0 37	73	23	83	8
54	54	64	35	74	21	84	7
55	52	65	33	75	20	85	6
56	50	66	32	76	18	86	4
57	48	67	31	77	17	87	3
58	46	68	30	78	15	88	2
59	44	69	28	79	14	89	1
60	42	70	26	80	12	90	0
61	40	71	25	81	11		

Geometrical Definitions.

Magnitudes are of three kinds, (viz) lines, Superficies, and Solids.

1. A Solid is that which hath length, breadth, and depth or thickness; its limits or boundaries, are called Superficies, So that

2. A Superficies, hath length & breadth without thickness; the limits of which are are lines.

3. A Line then, hath only length, and is bounded by points; So that

4. A point Mathematical, is incapable of being divided, and therefore hath no parts.

5. A right line, is that which lies evenly between its points; or is the nearest tract between its points, as A B

A _____ B

6. A curved line or arch does not lie equally, but bendeth evenly between its extream points, as C D

C ⌒ D

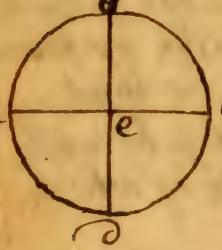
7. A plain Superficies is that which lies equally between its lines.

8. Two lines are said to be parallel, which being infinitely produced will not meet as the lines A B and C D.

A _____ B

C _____ D

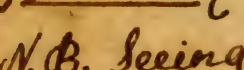
9. A Circle, is a plain Superficies bound=
=ed by, or contained under one line called the circumference; unto which all lines drawn from one certain point within the figure, are equal, as. a, b, c, d, e,.



10. And that point is called the Center as, e
11. And the lines so drawn are called the Radii, as, ae or, c, e.
12. And if the Radii are con=
tinued through to the oppo=
=site (side) part of the circumference, they are called Diameters, as, ac, or b, d.

N.B. That the circumference of every circle, is by mathematicians divided into 360 equal parts, called degrees, every Degree into 60 equal parts, called mi=
=nutes, and every minute into 60 equal parts called Seconds &c. So that the arch of the Semicircle contains 180 Degrees, and the Quadrant is equal to 90 Degrees.

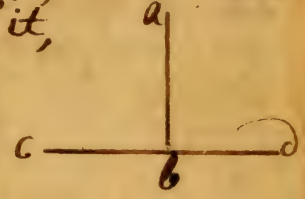
13. A plain Angle, is the inclination of two right lines the one to the other a touching one another both in the the same Streight line as. abc.



N.B. Seeing angles are measured by arches of circles described from their angular points, and intercepted between the lines which form the angles, every angle

angle is Said to be greater or leſs than another, according to the proportion which the Said arch hath to the circumference of the Same circle whereof it is a part.

14. When a right line as a, b, So Stands upon another right line, c. d. as to make the angles on each Side of it, a b d, and a b c equal to each other, then are thoſe equal angles called, right angles; and the line a, b, perpendicular to, c d.



15. An obtuſe angle is greater than a right angle as, a b c.

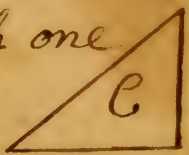
16. An acute angle is leſs than a right angle as, a b d.

17. A plain triangle is bounded by three right lines, called Sides

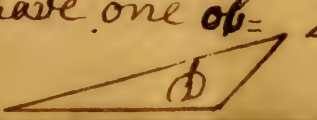
18. An Equilateral triangle, is one that has all its Sides equal to one another as the triangle A

18. An Equicrural triangle has only two Sides equal as B

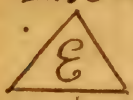
19. A right angled triangle hath one right angle as, C.



20. Obtuſe angled, have one obtuſe angle. as D

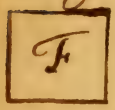


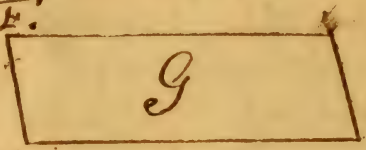
21. Acute angled triangles have all their angles acute, as the triangle E.



22. Two triangles are said to be Similar when the several angles of the one are equal to the several correspondent angles of the other.

23. A Square is a plane figure contained under four equal sides, and four equal angles as F.





24. A Parallelogram is a four-sided figure whose opposite sides are parallel and equal, as G.

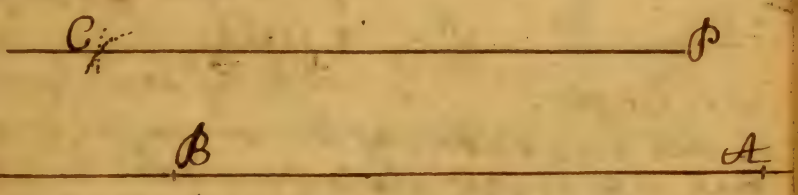
25. A Rectangle is a four-sided figure whose opposite sides are parallel and equal, and all its angles right.

26. Four numbers, lines or quantities are called proportionable when the first as of contains, or is contained in the 2d as the third contains, or is contained in the fourth, &c.

Practical Geometry.

Problem I.

Thro' a given point P to draw a right line PC that shall be parallel to a given right line AD.



1. Take the distance from the point given P to any point A of the given line AD.
2. With the same distance setting one foot of the compasses in the line AD any where at pleasure, as in B, sweep the little arch at C.
3. With the distance AB setting one foot of the compasses in P, cross the former arch at C.
4. Thro' the intersection at C, an the given point P draw the right line CP, and it shall be parallel to AB.

Prob. II.

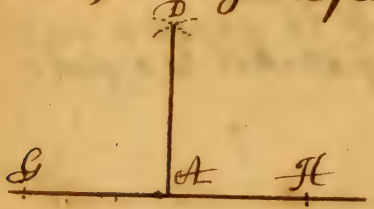
To bisect a given right line AB.

1. With any extent of the compasses (greater than half AB) setting one foot in A, sweep two small arches, one at C, and one at D.
2. With the same extent of compasses, setting one foot in B, cross the former arches.
3. Thro' the intersections at C & D, draw the right line CD, which will bisect the given line AB.

Prob.

Problem III.

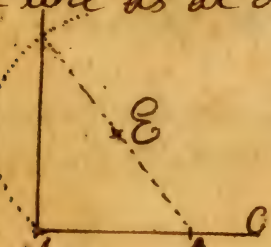
From a given point in a given right line, to raise a perpendicular.



If the point be in or near the middle of the line as at A,

1. Make A G equal to A H of any convenient length.
2. With any extent of the compasses greater than A H or A G, placing one foot in G, describe a small arch in D.
3. Setting one foot in H, with the same extent cross the arch at D.
4. Thro' the intersection at D and the given point A, draw the right line A D, and it shall be perpendicular to G H.

But if the point given be at the end of a line as at A.



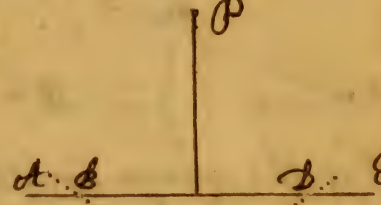
1. With any extent of the compasses, setting one foot in A, place the other in any point above the line A C, as in E.
2. On the foot at E as a center, with the same extent of the compasses describe the arch of a semicircle B A D.
3. Thro' the point B & E, draw the right line B D till it cut the arch in D.
4. Then from the point A thro' the intersection at D, draw the right line A D, & it shall be perpendicular to A C.

Prob.

Problem IV.

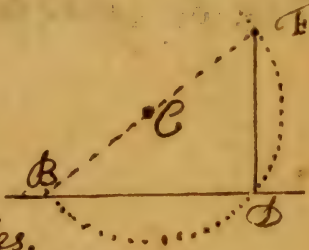
From a given point over a given line, to let fall a perpendicular

If the given point P be over the middle of the line,



1. With any convenient extent of the compasses, setting one foot in P describe the arch of a circle interfecting the given line in B & D.
2. Biffect the line BD in C by Problem 2.
3. From the point P to C draw the line PC, and it shall be the perpendicular required.

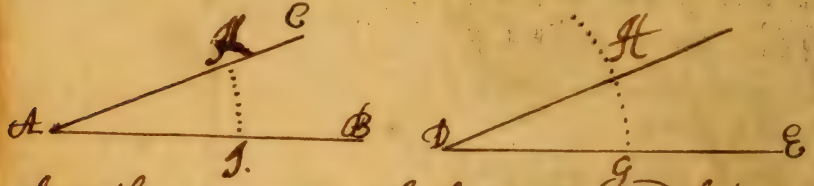
But if the point given be over the end of a line, as F,



1. Draw the line FB at pleasure.
2. Biffect BF in C, by Prob. 2.
3. on C as a center describe the arch FDB, with the distance CF in the compasses.
4. From the point F to the interfection at D draw the line FD, and 'tis done.

Problem V.

To make an angle equal to a given angle.



Let the given angle be C A B, and let it be required to form an angle on the given line D E equal thereto.

1. On A and D, as centers, with the same extent of Compasses, describe the arches I K and G H.
2. Make G H equal to I K.
3. Draw the line D H F, then will the angle F D E be equal to the angle C A B.

Trigonometry.

Trigonometry is that part of Geometry which is employed about the measuring of Triangles, and is either plain or Spherical: Before we enter upon Spherical, we Shall treat upon plain, and in order thereto, premise Some things already proved.

I. That a plain triangle is a figure bound=ed by three Streight lines lying in the Same plain, of which any two Sides is grea=ter than the third.

2. That the greateſt angle is oppoſite to the greateſt Side, and that the greateſt Side Subtends the greateſt angle.

3. That the Sum of the angles of every plain triangle is equal to a Semicircle, or 180 degrees. Wherefore

Coroll.

I. If two angles of a plain triangle are known, the third is alſo known.

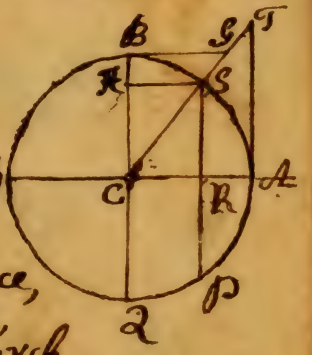
2. If one angle of a triangle be obtuſe, each of the other two Shall be acute.

3. If one angle be right, the Sum of the other two Shall be equal to one right.

4. In a right-angled plain triangle, if one of the acute angles be given, the o=ther is alſo known, being what the given angle wants of a quadrant, and this de=fect is called its complement.

Lines usually apply'd to the circle, are Chord, Sines, Tangents, and Secants.

Definitions.



1. The Chord or Subtense of an arch, is a right line drawn within the circle, and dividing ~~the circle~~ into two parts the circumference, and is a Chord to them both, thus; GP is a Chord of the arch GtP as also of the arch GBP.

2. The right Sine of any arch, is a right line drawn from one end of an arch perpendicular to the Radius drawn thro' the other end of the arch, or it is half the chord of twice that arch: thus; GR is the right Sine of the arch Gt, or of the arch GD.

3. The versed Sine is that part of the diameter which is contained between the right Sine and the arch; RA is the versed Sine of the arch GA, and RD of GD.

4. the tangent of any arch, is a right line drawn from one end of the diameter and perpendicular thereto, and limited by a right line drawn from the center thro' the other end of the arch; thus; AT is the tangent of the arch GA, and also of the arch GD.

5. A Secant is a right line drawn from the center to the extremity of the tangent: thus, CT is the Secant of the arch GA

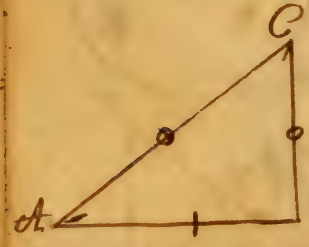
Plain Trigonometry.

Case I

The angles and one of the legs being given, to find the other Leg.

Example.

Given $\left\{\begin{matrix} AB = 64 \\ \angle A = 36^\circ \end{matrix}\right\}$ BC required



The Construction.

1. Make $AB = 64$ by a line of equal parts.
2. Raise the perpendicular BC.
3. Make the angle at $A = 36^\circ$, and produce the line AC till it meet the perpendicular in C.
4. Then is the Triangle determined and BC measured by a line of equal parts will give its length.

Arithmetically, thus,

As the Radius
To the Tang. of the $\angle A$
So is the given leg AB
To the required leg BC.

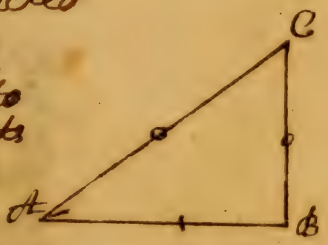
Case II.

One of the Legs and the Angles being given, to find the Hypothenuse.

Example.

Given $\begin{cases} AB = \\ \angle A = \end{cases}$ } AC required.

This case is constructed exactly as the former and if AC be applied to a line of equal parts, its length will be known.



Arithmetically, thus,

As the Sine of $\angle C$
to the radius
So is the given leg AB
to the Hypothenuse

Case III.

Given the Hypothenuse and angles, to find one of the legs.

Example.

Given $\left\{\begin{matrix} AC = 79 \\ \angle A = 29^\circ 30' \end{matrix}\right\}$ AB required.

The Construction.

1. Draw the line AB at pleasure.
2. make the angle at A = to 29° 30', and continue the line AC till it be equal to 79.
3. Let fall the perpendicular CB, then is the triangle compleat.
4. and AB the leg required, and if measured by a line of equal parts, will give its length.

Arithmetically, thus,

As Radius
to the Sine of ∠C
So is the Hypothenuse
to the Leg required

Case IV.

The Legs being given, to find the angle.

Example.

Given $\left\{\begin{matrix} AB = 60 \\ BC = 53 \end{matrix}\right\}$ $\angle$s at A & C required.

The Construction.

1. Let AB be made equal to 60 of a line of equal parts.
2. On B raise the perpendicular BC, and lay off upon it 53 parts of the same Scale from B to C.
3. Join the points A and C by the right line AC, and the triangle will be compleated, and if the angles at A & C be measured by a line of Chords, their quantities will be known.

Arithmetically, thus,

As the Leg AB
to the leg BC
So is Radius
to the tang. of $\angle$ at A

and

As BC
to AB
So is Rad.
to tang. C.

Case V.

The Legs given, to find the Hypothenuse.

Example.

Given $\left\{\begin{matrix} AB = 60 \\ BC = 53 \end{matrix}\right\}$ AC required.

This case is constructed exactly as the former: and if AC be measured by the same scale by which the triangle was projected, its length will be known.

And if an answer be required by numbers,

1. Find the angles by case 4th.
2. Find the Hypothenuse by case the 2d.

Or,

The Square root of the Sum of the Squares of the two legs, will be the length of the Hypothenuse.

Case VI.

The Hypothenuse and one of the legs being given, to find the angles.

Example.

Given $\left\{\begin{matrix} AC = 80 \\ AB = 64 \end{matrix}\right\}$ Ls at A & C required.

1. Let AB be made equal to 64 by a line of equal parts.
2. Raise the perpendicular BC.
3. With the distance 80 between the points of the compasses, setting one foot in A, with the other cross the perpendicular in C.
4. Draw the line AC, then is the triangle projected, and the angles may be measured by a line of Chords.

Arithmetically, thus,

As Rad.
to the Sine of L at C
So is
As the Hypo. AC
to the Given Leg AB.
So is radius
to the Sine of the L at C.

Case VII.

The Hypothenuse and one of the legs being given, to find the other Leg.

Example.

Given $\left\{\begin{matrix} AC = 80 \\ AB = 64 \end{matrix}\right\}$ AC required.

The Construction of this case, is the same with the former, and BC may be measured by a line of equal parts.

The Angles may be found by the last case, and Then the Leg BC may be found by case the 1st or case the 3d.

Or the Square root of the difference of the Squares of the Hypothenuse and one of the Sides, will be the other.

Plain Sailing.

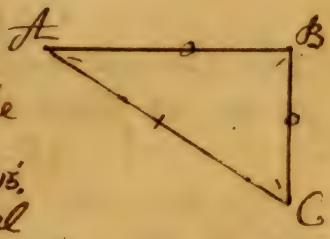
Case I.

The course and distance being given, to find the difference of Latitude and Departure.

Example.

Suppose a Ship from the Latt. 50° 10′ N. Sails S.W. by S. 57.5 miles, what is the Latt. She is in, and how much has She departed from the meridian?

The Construction.



Let AB represent the meridian of A the place She sailed from.

1. Make the angle BAC = 33° 45′.
2. Continue AC till it be equal to the distance Sailed 57.5 miles, & let fall the perpendicular CB. Then will C be the place the Ship is in, CB the Departure from the meridian, and AB the Alteration of Latitt.

Arithmetically, by case 3d of Trigo.

To find the Departure,

As Rad.
to the S. of Course
So is the distance AC
to the departure AB

For the difference of latt. thus

As Rad
to the S.C. of the Course
So is the distance
To the Diff of Latt.

By reason of Several accidents, as currents Setting with or againſt the Courſe of the Ship, unſteadin of the winds &c. the eſtimate diſtance by the log, is viciated; and conſequently the diff. of Latt. and departure thus found are not to be relied on. But the true diff. of latt. being got by obſervation, by the help of the and the courſe find the diſtance and depar=ture, by the following caſe.

Caſe II.

The Courſe and diff. of Latt. being given, to find the diſtance, and departure.

Example.

A Ship from the Latt. 50° 10′ N. Sails S.W. by S. untill She be in the Latt. 49° 18′ N. I demand the Diſtance Sail'd, and departure from the merid.

The Conſtruction.

1. Make AB equal to the Diff. of Latt. 52, and raiſe the per=pendicular BC.
2. Make the Angle BAC = to the Courſe 33° 45′, and continue AC till it meet the perpendicu=lar in C; Then is AC the diſt.

Arithmetically,

As the Sc. courſe
to Rad.
So is the Diff. of Latt.
to the Diſt

As Rad.
to the tang of Courſe
So is the Diff. of Latt.
to the departure

But if you have no reason to suspect the distance Sailed, but mistrust your course, by reason of poor Steerage, thwart currents &c. Then with the true Diff. of Latt. & Dist. find the course and Departure by the following case.

Case III.

The Diff. of Latt. and Distance Sailed being given, to find the course and Departure.

Example.

A Ship from the Latt. 50° 10′ N. Sails between the South and the west 57,5 miles, and then by observation, is found to be in the Latt. 49° 20′ N. I desire to know her true course and Departure?

The Construction.

1. Let AB be made equal to the Diff. of Latt. 50 minutes.
2. On B raise the perpendicular BC.
3. With the Distance Sailed between the compasses, Setting one foot in A the place departed from, with the other, cross the perpendicular in C, the place the Ship is in; and the angle BAC is the direct course.

Arithmetically

As the Dist.
To the Diff. of Latt.
So is Rad.
To the S.c. course.

As Rad.
To the S. of course
So is the Distance
To the Departure.

Plain Sailing.

If the Diff. of Latt. and Departure between the Ship and any other place be known, then the courfe and Diftance to it, may be found by the following cafe.

Cafe IV.

The Diff. of Latt. and departure being given, to find the Courfe & diftance.

Example.

A Ship in the Latt. 50° 10′ north, is bound to a port in the Latt. 41° 01′ N. the Departure betwe the places being 33 miles E. aft. I demand, upo what courfe and how far, She muft Sail, to gain her intended port?

The Conftruction

1. Make AB equal to 52 miles, the diff of Latt.
2. Raife the perpendicular BC equal to the Departure 33 miles. Then is the angle ABC the Courfe

Arithmetically.

As the diff. of Latt.
to the Departure.
So is Radius
to the tang. of the courfe

As the Sine of the Courfe
to Radius
So is the Departure
to the Diftance

Plain Sailing.

Cafe V.

The Diftance and Departure being given, to find the Diff. of Latt. and Courfe.

Example

A Ship from the Latt. 40° 16′ N. Sails between the N. & the E. 59 miles, until her Departure be 33 miles. I demand her Courfe, and the Latt. She is in?

The Conftruction.

1. Having drawn the meri= dian AB, raife the perpen= dicular BC equal to the De= parture 33 miles; then
2. With the Diftance Sailed be= tween the points of the compaffes, letting one foot in C, the place the Ship is in, with the other croſs the meridian in A, the place Departed from, and the courſe may be found,

Arithmetically.

As the Diff.
To the Depart.
So is Rad.
To the S. of the Courſe.

As the tang. of the courſe
To Rad.
So is the Depart.
To the diff. of Latt.

Case VI.

One Latt. Course and Departure being given, to find the latt. the Ship is in, and her distance Sailed.

Example.

A Ship from in the Latt. 40° 10' N. Sails N. E. by N. ¼ E. until her departure be 33 miles; I demand the distance Sailed, and the Latt. the Ship is in?

The Construction.

1. Make the angle of the Course BAC equall to 36° 34'.
2. With the Departure 33 draw BC parallel to the meridian, till it meet AC produced in C, which is the place the Ship is in, & AC the distance Sailed.

Arithmetically,

As the S. of the Course
to radius
So is the Departure
to the distance

As the tang. of the course
to Rad.
So is the Depart.
to the Diff. of Latt.

N.B. this might been better constructed.

Propertys of Triangles which the Geometers have demonstrated.

In all plain triangles, the Sides are proportional to the Sines of their oppofite angles.

In every triangle, as well plain as Spherical, the Sines of the Sides, are proportional to the Sines of their oppofite angles.

In every plain triangle it will be,
As the Sum of any two Sides: to their Difference
:: So is the tang. of half the Sum of their oppofite angles: to the tangent of half their difference.

And,
As the Longeft Side: to the Sum of the other two:: So is the difference of the two Sides: to the diff. of the two Segments of the base, made by a perpendicular let fall from the oppofite angle.

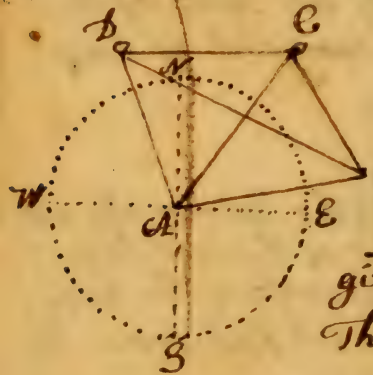
If any angle of a plain triangle be biffected, the Biffecting line will divide the oppofite Side, in the Same proportion as the legs of the angle are to one another.

If the verticall angle of any plain triangle be biffected, the diff. of the rectangles, made by the Sides & the Segments of the base, is equal to the Square of the line that biffects the angle.

The Doctrine of oblique-angled plain Triangles applied to Sailing.

Case I.

Coasting along Shore I See two Head-lands the first bears N.N.W. the Second N.N.E. then Standing away E. by N. 16 miles, the first bears from me W.N.W. the Second N.W. by N. I demand the distance of each of these ports from the first place and also their bearing and distance from one another.



Let A, be the place of the Ship at first; B the place She Sailed to.

Whence,

In the triang. DAB are given,

The ∠ DAB =
ABD =

and the dist. Sailed AB 16 miles

Therefore, S, ADB : S, ABD :: AB : AD.

In the triangle ABC are given

the ∠ BAC =
ABC =
} an. AB 16 miles, whence

S, ACB : S, ABC :: AB : AC.

In the triangle DAC are given

DA = miles & AC = miles, & ∠ DAC =

whence

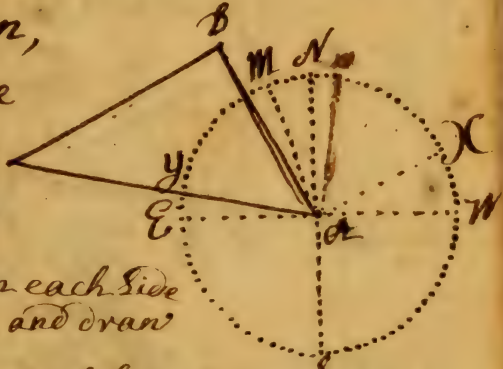
AC + AB : AC − AB :: t, ½ ABC + ACD : t, ½ ABC − ACD.

And S, ADC : S, DAC :: AC : DC.

Case II.

A Ship bound to a port that lies N.E. by N. W. distant 325 miles, the wind being N. by E. and She being able to lie no nearer the wind than 6½ points, I demand how many miles She muſt Sail upon her Larboard-tack, and how many upon her Starboard, to gain her deſired port?

The Conſtruction,



. Let A be the place he Sail'd from, & the place She is bound to, & M the ourſe of the wind.

. Set off 6½ points on each ſide the wind to X & Y, and draw A Y & A X.

. Thro' D draw DE paralel to X A, ill it meets A Y produced in E, then will AE & ED e the diſtances required.

In the triangle ADE there are given, AD = 325 miles. ∠DAE = 53° 26'. ∠ADE = 81° 11½. & the ∠AED = 39° 22½. thence

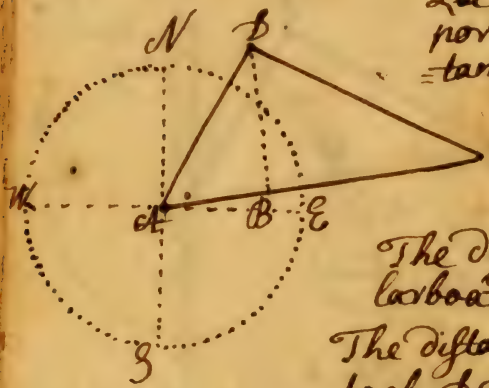
S, AED : S, ADE :: AD : AE. And

ſo the S, AED : S, DAE :: AD : DE.

This problem is of uſe in finding the ſhorteſt way when the winds are contrary.

Case III.

Admit two ports lie N. N. E. and S. S. W. dist. 300 miles, and the wind being at north, a Ship Sails from the Southermost, close hauld upon the wind 510 miles, with her Larboard tack on boord, & then 410 miles with her Starboard tack and then arrives at the northermost. I desire to know how near the wind She makes her way good upon each tack.



Let A & D be the two ports, AE & DE the distances upon each tack. In the triangle ADE E are given, the dist. of the ports AD 300. The distance run upon the larboard tack AE 510. The distance upon the Starboard tack DE, 410.

To find the angle DAE (having let fall the perpendicular DB) it will be

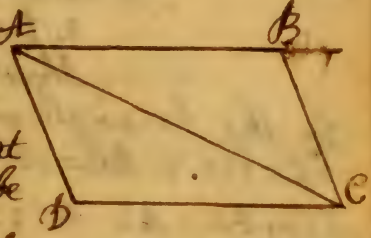
As, AE : DE + AD :: ED − DA : EB − BA.

Then, as, AD : AB :: Rad. : S.c. ∠ DAE.

Of Currents.

If a current Set with, or againſt the courſe of a Ship, it increaſſes or diminiſhes the Ship's motion, as much as is the drift, or rate of driving.

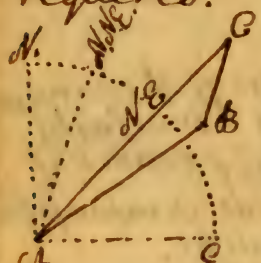
If the Ship thwart the motion of the current it not only leſſens or augments her velocity, but gives her a new motion, compounded of that of the Ship and current: as is manifeſt from the principles of Mechanicks.



For, a body moved by two forces, one in the direction AB, & another in the direction AD, ſo that with the firſt force it will deſcribe AB in the ſame time that with the other it will deſcribe AD: with both theſe forces acting together it will deſcribe AC, and in the ſame time that with each of the forces it would have deſcrib'd its reſpective Side,

Of Currents.

If a Ship Sails N.E. 110 miles, in a current that Sets S.S.W. 30 miles in the same time, her true courfe and diftance Sailed is required.



The Conftruction.

1. Set off 4 points from N. to=wards eaft, and draw AC equal to 110 miles.
2. From C, draw CB parallel to the line N.N.E. and equal to 30 miles.
3. Draw AB which will be the Ships true Courfe, to find which

In the triangle ABC there are given AC=110 & BC=30. & ∠ at C=22° 30', thence

$AC+BC : AC-BC :: t, \frac{1}{2} \overline{\angle A + \angle B} : t, \frac{1}{2} \angle B - A$

and

As S, ∠A : S, ∠C :: BC : AB.

If a Ship from the Latt. 36° 30' South, Sails N.E. by N. 40 miles, then N.E. by E. 36 miles in a current that Setts S.S.E. 20 miles in the time that the Ship Sails 38 miles, and it be required to find the direct courfe and diftance between the Ship and her firft place & alfo the Latt. the Ship is in.

Having conftructed it as in the former example,

In the Triangle ACB are given AC=40

and

and the angle
at C = 56° 15'.
and BC = 21,05 miles.
To find AB, and
the angles at
A & B.

AC + BC : AC − CB :: $t, \frac{1}{2}\overline{\angle A + \angle B}$: $t, \frac{1}{2}\overline{\angle B - \angle A}$.

And as, $\sin$, CAB : $\sin$, ACB :: CB : AB.

2. In the triangle BDG, are given
BD = 36. the ∠ at D = 78°, 45'. DG = 18,95 miles
Wherefore

BD + DG : BD − DG :: $t, \frac{1}{2}\angle DBG + \angle BGD$: $t, \frac{1}{2}\overline{\angle G - \angle B}$

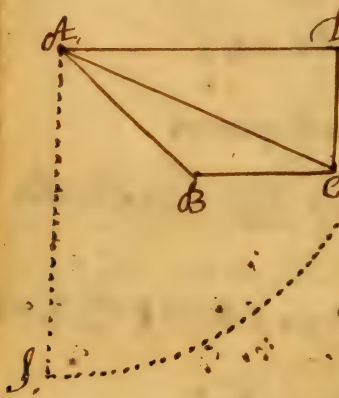
And as, $\sin$, ∠DBG : $\sin$, BDG :: DG : BG.

3. In the triangle ABG are given
AB = 33,28 miles, & BG = 37,27 miles, and the
∠ ABG = 159° 19', Whence muſt be found the
angle BAG, and AG.

As, AB + BG : BG − AB :: $t, \frac{1}{2}\overline{\angle A + \angle G}$: $t, \frac{1}{2}\overline{\angle A - \angle G}$

And, as, $\sin$, BAG : $\sin$, ABG :: BG : AG
Then
As Rad : $\sin$, ∠ N. AG :: AG : Diff. of Latt.

Admit, a Ship from a certain Headland, in the Latt. 34° 00' North, Sails S. E. by S. 24 miles in 6 hours, in a current that Sets between the North & the East; and then the Cape is found to bear W. N. W. and the Ship to be in the latt. 33° 45' North. I demand the Setting and drift of the current.



The Construction.

1. Set off 3 points from S towards E, and draw the line AB = 24 miles
2. Set off two points from from E towards S, and draw the line AC.
3. At the distance of 15 miles, equal to the diff. of latt. draw a parallel to AE, till it intersect AC in C.
4. From the intersection at C, draw CD parallel to AS; also the line BC the drift & Setting of the Current.

To find which Arithmetically.

In the Triangle ADC, right angled at D, are are given { DC = 15 miles, ∠A = 22° 30' } to find AC

As the S. ∠A : Rad. :: DC : AC.

Again

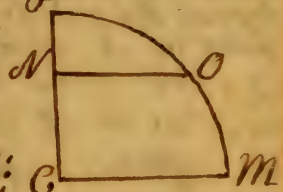
Again, in the triangle ABC, are
Given AB=24. ∠A=33° 45′. & AC=39,2.
to find the ∠s C & B, & the line BC.
Wherefore

$AB+AC : AC-AB :: t,\frac{1}{2}\overline{\angle B+\angle C} : t,\frac{1}{2}\overline{\angle B-\angle C}$

And, S, ∠B: S, ∠A:: AC: BC.

These four following problems go by the name of Parallel Sailing.

The degrees of Longitude grow less & less, the nearer you approach the poles, as is manifest from the following figure, in which P represents the Pole, PQM a quadrant of the meridian, CM the Semidiameter of the Equator, and NO a Semidiameter of any parallel of Latitude, which is to the Semidiameter of the Equator, as the Sine of the arch PQ to the Sine of the arch PM: that is, as the Co-Sine of the latt. to Radius.

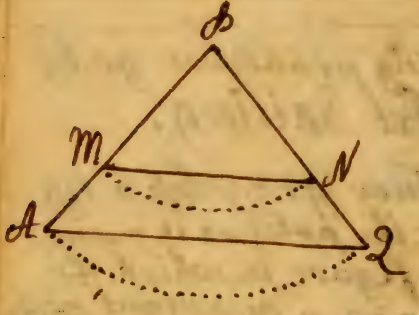


Now, Since the Circumferences of all circles are as their radii directly, and that like parts have the same proportion with their wholes, it follows that the breadth of a degree of Long. in any parallel of latt. is to the breadth of a degree in the Equator, as the Co-Sine of that latt. to the Radius: and consequently as the miles in one, to the miles in the other.

Sailing on a parallel of Latt.

Problem I.

If the diff. of Longitude between two place both in one parallell of Latt. be given, to find the diftance between them, i.e.
If a Ship in the latt. 49° 30′ N. or S. Sail directly eaft or weft, untill her difference of Longitude be 3° 30′ and it be required to find her diftance Sailed.



The Conftruction.

1. Having drawn the line AP equal to the Sine of 90° degrees make PM equal to the Sine of the Complement of the latt. and defcrib the arches A2 and MN

2. With the diffference of Longit. converted into miles, and taken off a Scale of Equal parts, be=tween the points of the compaffes, Setting one foot in A, with the other crofs the arch A2 in 2, and draw P2, and where it cuts the arch MN as in N, draw the line MN, which will be the diftance required.

Arithmetically thus,

As Rad.
to the Co-Sine of the Latt
So is the miles of Longit.
to the diftance Sailed.

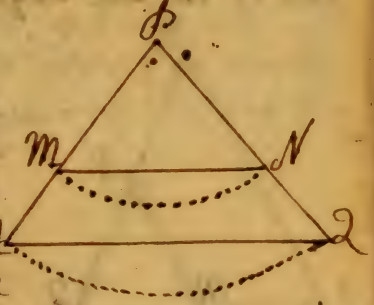
Parallel Sailing.

Problem II.

If the diſtance in any parallel of Latt. be given, to find the difference of longitude.

If a Ship ſail 156 miles eaſt or weſt, in the latt. 47° 17′ North or South, and her diff. of Longit. be required.

The Conſtruction.



Having made, as before PA = to the Sine of 90°, and PM = to the Co-Sine of the latt. and drawn the arches MN & A2, make MN equal to the diſtance run, and draw PN to 2, as alſo A2; which will be the alteration of longitude, and to find it

Arithmetically,

PM : PA :: MN : A2. i. e.

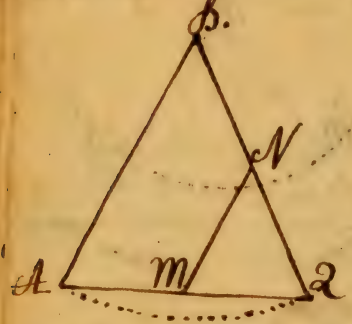
As Co-S. of latt.
to Radius
So are the miles of diſtance
to the minutes of Longit.

Parallel Sailing.

Problem III.

If the distance Sailed under any parallel of Latt, and the diff. of Longit. were given, to find the latt. i.e.

If a Ship in Sailing 180 miles east or west alters her longitude 6° 00', and the latt. she is in be required.



The Construction

1. Make P2 equal to the Line of 90°, and Sweep the arch A2
2. Make the line A2 equal to the miles of longitude given.
3. Set off the distance run from 2 to M, and draw MN paralel to AP, then N2 be the Line of the Complement of the latt; to find which

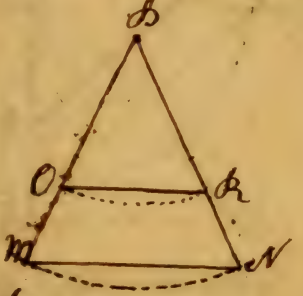
A2 : M2 :: P2 : N2. i.e.

As diff. of Longit. in miles
to the distance run
So is Radius
to the Cosine of the Latt.

Parallel Sailing.

Problem IV.

Supposing two places under the same parallel of latt, distant 220 miles, and two other places under the same meridians with the former, differing in latt. from the former 6° 00′ and the distance of the two last places were required, i.e. If two Ships in the latt. 45° North, distant 220 miles, sail both directly north 360 miles, and it be required to find their distance asunder.



Having reduced the distance sailed into degrees and added it to the latt. sailed from,

1. Make PM = to the Sine of the Complement of the latt. they sailed from, and PO = to the Co-Sine of the Latt. they sailed to, and describe the arches MN & OK.

2. Let MN be made equal to the distance given, and draw PN: where it intersects the arch OK as in K draw the line OK which will be the distance required; to find which, it will be

PM : PO :: MN : OK. i.e.

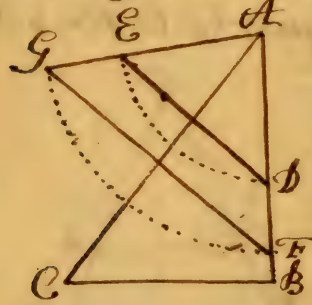
as S.c. of latt. sailed from
to S.c. of latt. sailed to
So is the distance given
to the distance required.

Sailing by the Middle-Latitude

Case I.

One Latt. Courſe and Diſtance ſail'd being given, to find the difference of Longitude.

If a Ship from the Latt. 48° 20′ North, S.W. by S. ½ W. 87 miles, and it be required to know how much ſhe has altered her Longitude.



1. Having conſtructed the triangle ABC, as in caſe the firſt of plain ſailing; take the Line of the complement of the middle latitude, and ſweep the arch DE, till its chord be equal to CB, and draw AE.

2. With the Line of 90° ſetting one foot of the Compaſſes in the arch FG, till it meet AE produced in G, and draw FG, which will be the Diff. of Longit. Sought.

R: S, ∠BAC :: AC: BC. and

R: S.C. ∠BAC :: AC: AB.

hence the Ship will be found to be in the latt. 47° 12′. and the middle latt. 47° 46′. then as AD: AF:: DE: FG.

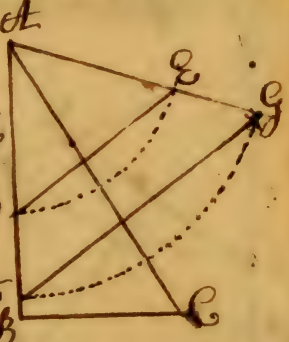
or thus

as S.C. mied. latt.
to S. Courſe
So is the diſtance ſail'd
to the Diff. of Longitude.

Case II.

If both Lattitudes and Course were given, to find the Diff. of Longitude.

If a Ship from the Latt. 47° 30′ North, Sails S. E. by S. and then is found to be in the latt. 46° 20′ North, and it be required to know the Difference of meridians.



1. Find the diff. of latt. and form the triangle ABC according to Case 2d of plain-Sailing.
2. Make Ab equal to the Sine of the Complement of the middle latt. and AF to the Sine of 90°, and describe the arches bE & FG.
3. Make bE equal to BC, and produce AE till it meet FG the arch in G, & draw FG the diff. of Longitude. to find which, find the Departure & the Distance, as in Case 2d of plain-Sailing; then

AD: AF:: DE FG. i. e.

As S. C. midd. Latt.
to Rad.
So is the Departure
to the diff. Longit.

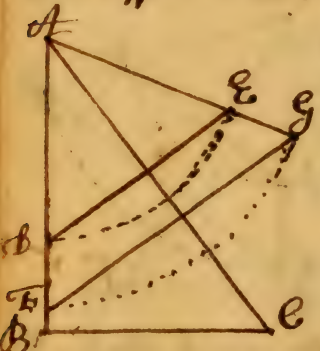
Or thus

As S. C. midd. Latt.
to tang. Course
So diff. latt.
to diff. Longit.

Case III.

If the diff. of Latt. and distance Sailed, were given, to find the diff. of longitude.

If a Ship from the latt. 47° 50′ North, Sails between the N. & E. 78 miles, and then, by observation is found to be in the latt. 48° 55′ and it be required to find the difference of longitude.



The Construction.

Find the Departure by case 3d of plain Sailing, & by the help of it & the middle latt. find, by the two former cases, the diff. of longit. find the course as in plain Sailing, case 3d. & then

As S. C. midd. latt.
to Rad.
So Departure
to the diff. longit.

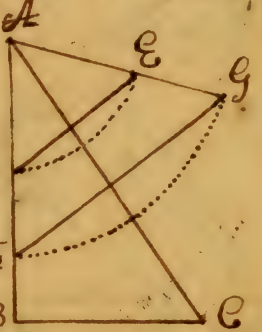
OR thus,

As S. C. middle latt.
to S. course
So dist Sailed
to Diff. of longit.

Case IV.

If the difference of longitude and Latt. of two places were given, to find the course and distance between them, i. e.

If a Ship in the latt. 47° 20′ N. be bound to a port in the latt. 48° 38′ N. the difference of longitude being 1° 02′, and it be required to know upon what course She must Sail, and how far.



The Construction.

1. With the Sine of 90°, describe the arch FG, and make the line FG = 1° 02′ off a Scale of equal parts, & draw the line AG.
2. Make AD = to the Co-Sine of the Midd. Latt. and Sweep DE till it cut AG in E, & draw DE.
3. Make AB = to the diff. of latt. & BC = to the Departure DE, & draw AC, which will be the distance & the angle BAC the course.

As AF : AD :: FG : DE.
As AB : (DE =) BC :: R : t, BAC
So S, BAC : R :: BC : AC.

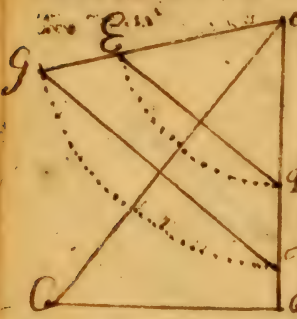
Or Thus,

As diff. Latt.
To diff. Longit.
So S. c. mid. Latt.
to tang. course.

Case V.

If one latt. course and Departure were given, to find the difference of Longitude.

If a Ship from the latt. 44° 30′, N. Sails S. W. by S. ½ S. until her Departure be 52 miles, and her diff. of longitude be required



Make the triangle ABC according to the 6th case of plain-Sailing, and Substract ½ the diff. of latt. AB from the latt. given, and Set off the Sine of the Complement of the remander from A to D, as also the Sine of 90° to F, make DE = BC, and continue AE till it meet FG in G, then will FG be the difference of longit. Sought.

Find the diff. of latt. & Distance as in plain-Sailing.

For the diff. of Longitude,

AD : AF :: DE : FG.

Middle Lattitude.

Case VI.

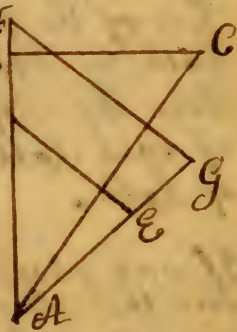
If the difference of Longitude and Departure were given, to find the Latt. the Ship is in, as also her course & distance. i.e.

If a Ship from the latt. 43° 20′, Sails between the N. & the E., untill her difference of Longitude be 1° 10′, and her departure 50 miles; and it be required to know upon what course She has Sailed, and how far, as also the latt. She is in.

The Construction.

1. Make AF equal to the diff. of Longitude in miles, and AD to the Departure.

2. Lett AG & FG be each made equall to the Sine of 90° and draw DE parallel to parallel to FG then will AE. be the Cosine of the latt. the Ship is in.



3. Make AB equal to the diff. between the latt. first given and last found, and BC=AD, and draw AC, the distance Sailed.

Arithmetically,

AF : AD :: AG : AE. i.e.

As diff. of longit.
to the Departure
So Radius
to S.C. ~~Sine~~ latt.

Mercators Sailing.

Prob. I.

If it were required to find the meridional diff. of Latt. between any two places, i.e.

Case I.

If one place be under the Equator, and the other in N. or S. latt.
Then the Meridional parts answering to the latt. propofed, will be the meridional diff. of Latt.

Case II.

If the places propofed are on the same Side of the Equator; that is if they are both in North or both in South Lattitudes, then the difference of the meridional parts of each Latt. will be the meridional differ. of Latt.

Example

If one place be in the Latt. 50° 10' North, and the othe in the Lattitude 13° 00': the meridional difference of latt will be found to be 2703 thus

From the merid. parts answering to 50° 10'	3419
Take the merid. parts answering to — 13° 00' —	716
Remains the merid. diff. of Latt ———	2703

Case III.

If the places propofed are on contrary Sides of the equator. that is, if one be in North, the other in South Latt. then the Sum of the meridional parts answering to Each Latt. will be the meridional difference of Latt.

Example

Example.

If one place be in the Latt. 28° 20′ North, the other in the Latt. 35° 50′ South; and it were required to find the meridional diff. of Latt.

To the merid. parts answering to	28° 20′	1773,9
Add the merid. parts answering to	35° 30′	2305,7
The Sum is the merid. diff. of Latt.		4079,6

Prob. II.

If the Latt. and Diff. of Longitude of any two places be given, to find the Course, Distance and Departure.

Example.

If a Ship at the Lizard in the Latt. 50° 10′ N. be bound to Barbadoes, in the Latt. 13° 00′ N. the Diff. of Longitude being 52° 58′ and it be required to know the Course from the Lizard to Barbadoes, as also the distance between them.

The CONSTRUCTION.

Having found the merid. diff. of Latt. 2193 by the last Prob. Set it off from A to D.

Make D E equall to 3178, the Diff. of Longit. in minutes, & draw A E.

Make A B equal to the diff. of Latt. in minutes 2230, and draw B C parrallel to D E, then is the ∠ at A the Course, A C the distance, and B C the Departure; to find each of which,

Arithm.

Mercators Sailing.

Arithmetically it will be

As merid. diff. of Latt. 2703
To the diff. of Longit. 3178
So is Radius
To the Tang. of the Course

The Distance and Departure may be found as in plain-Sailing.

Problem III.

If ONE Latt. Course and Distance Sailed, were given, to find the other Latt. Departure and diff of Longit.

Example.

A Ship from the Lizzard in the Latt 50° 10' North, Sails S. S. W. ½ W. 550 Leagues, and it be required to find the Latt. She is in, her alteration of Longitude and how much She has departed from her first meridian.

The Construction

1. Form the triangle ABC, and find the Latt the Ship is in, by Cas. the first of Plain-Sailing.
2. Find the meridional difference of Latt. by Prob. 1st and draw DE parallel to BC, till it meet AC produced, in E.

Arithmetically

Find the the Latt. the Ship is in, as in plain-Sailing. Then

Then for the diff. of Longitude

As Rad.
To the tangent Course
So is the merid. diff. Latt.
To the diff. of Longitude
Find the Departure as in Plain-Sailing.

Problem IV.

If both Lattitudes and Course were given to find the Distance, Departure, & diff. of Longit.

Example.

If a Ship from the Lizard in 50° 10′ North, sails S. S. W. ½ W. and then by Observation is found to be in the Latt. 24° 30′ North, and it be required to know how far She has Sailed, & how much She has altered her Longitude.

The Construction

Make the triangle ABC as Case 2ᵈ of Plain-Sailing.

Make AD equal to the merid. diff. of Latt. and draw DE, parald to BC till it meet AC produced in E.

Arithmetically

As Radius
To the tangent Course
So is merid. diff. of Latt.
To the diff. of Longit.

The Distance and Departure may be found as in Plain-Sailing.

Mercators Sailing.

Problem V.

If both Lattitudes, and Distance were given, to find the Courfe, & diff. of Longit.

Example.

If a Ship from the Lizard in 50° 10′ N. Sail between the South & the weft, until her diftance Sailed be 2000 miles, and then is found to be in the Latt. 24° 00′ N. and it be required to know upon what Courfe She has Sailed, & how much She has altered her Longitude.

The Conftruction.

1. Make the triangle ABC by Cafe 3d of Plain-Sailing.
2. Let AB be made equal to the meridional diff. of Latt. And draw BE parallel to BC till it meet AC produc'd.

Arithmetically,

Find the Courfe as in Plain-Sailing,
And for the diff. of Longitude

As Radius
to the Tang. Courfe
So is merid. diff. Latt.
to the diff. of Longit.

Problem VI.

If the Lattitude of any place were given and its bearing from any other, as also their diff. of Longitude, to find the Latt. of the other place, and their mutual distance.

Example.

If the diff. of Longitude between the Lizzard (in the Latt. 50° 10' N.) and Barbadoes be 52° 58', and the direct Course from the Lizzard to Barbadoes be S.W. 4° 3½ Westerly what is the Latt. of Barbadoes, & how far is it from the Lizzard?

The Construction

Make BE equal to the diff. of Longitude, & the ∠ BEA equal to the Compl. of the Course.

Then

As Radius
To Co-tang. Course
So is the diff. Longit
To the merid. diff. of Latt.

Now because Barbadoes is to the Southward of the Lizzard

From the merid. parts answering to 50° 10' — 3490
Take the merid. diff. of Latt. ——— 2703
Remains the merid. parts for Latt. Barbadoes — 787
which answer to 13° 00'

Set off the diff. of Latt. from A to B, and draw BC parallel to BE, then is AC the Distance, which may be found as in Plain-Sailing.

Problem VII.

If one Latt. Course and Departure were given to find the distance and Diff. of Longitude.

Example.

If a Ship from the Lizzard in the Latt 50° 10' N. Sails S. W. by S. ½ westerly, until her departure be 1010 miles and it be required to know how much She has altered her Longitude & how far She has Sailed.

The Construction.

1. Make BC 1010, and the Latt C, equall to the Compl. of the Course.

Find the distance and diff. of Latt. as in Plain-Sailing.

2. Make A D equal to the meridional diff. of Latt. and draw DE parallel to BC.

then

As Radius
To the tang. Course
So is merid. diff. Latt.
To the diff. of Longitude

Problem VIII.

If both Lattitudes, ~~Course~~ and departure were given, to find the Course and diff. of Longitude. i.e.

If a Ship from the Lizzard, in the Latt. 50° 10' North, Sails between the South & the west, untill She be in the Latt. 30° 00' N. and her departure be 978 miles, and it be required to know her diftance Sailed and her diff. of Longitude and Course

The Conftruction.

Set off the Common diff. of Latt. from A to B, and the meridional diff. of Latt. from A to D.

Raife the perpendicular BC equal to 978 miles, and continue AC till it meet DE in E. Then

As the Common diff. Latt. to the merid. diff. of Latt. So is the departure to the difference of Longit.

The diftance and Course may be found as in Plain Sailing.

Problem IX.

If one Latt. Distance and Departure were given, to find the course and diff of Longit.

Example.

If a Ship from the Latt. 50° 10′ North, Sails between the S. & the W. 1254 miles, and then finds her departure to be 875 miles, and it be required to know upon what course She has Sailed, her diff. of Latt. & her diff. of Longitude.

The Construction

1. Form the triangle ABC by case 5th of plain Sailing. And find the Course and difference of Latt. as in that case.

2. Set off the merid. diff. of Latt. from A to b, and draw DE, parallel to BC, then

As Radius
to the tangent Course
So is merid. diff. Latt.
to the diff. of Longitude

Arches	Lines
00° 01′	,0002908882045 63
00° 02′	,0005817763845 2
00° 03′	0008726645252 3
00° 04′	,0011633525721 3
00° 05′	,0014544405305 41 5 2321343
00° 10′	,0029088779843619
00° 20′	,0058177313549938
00° 30′	,0087265354983739
00° 40′	,0116352657978 42
00° 50′	0,0145438976514 5
01° 00′	,0174524064372 84
01° 00′	,0348994967025 1
03° 00′	,0523359562628 1
04° 00′	,0697564737441 17
05° 00′	,0871557427476 6
06° 00′	,1045284632676 1
07° 00′	1218693444040 9
08° 00′	1391731009599 4
09° 00′	1564344650 4 71334 true
10° 00′	1736481776 6 ~~3810297 true~~
11° 00′	1908089953765 52
12° 00′	2079116907985 70
13° 00′	2249510543517 48
14° 00′	2419218955996 71
15° 00′	2588190451025 208 true so far
16° 00′	2756373558170 04
17° 00′	2923717047206 37
18° 00′	3090169943941 36 true so far
19° 00′	3255681544571 48
20° 00′	3420201433257 9
21° 00′	3583679495453 82
22° 00′	3746065934160 22
23° 00′	3907311276231 65

Arches	Sines
89° 59′	99999995769202
89° 58′	99999983076810
89° 57′	99999961922824 9
89° 56′	99999932307247 7
89° 55′	99999894230249 6 32 1 1952 43
89° 54′	99999576920548640
89° 40′	99998307728733 6
89° 30′	99996192258088 0
89° 20′	99993230790376 5
89° 10′	99989423192712 4
89° 00′	99984769315640 9
88° 00′	99939082701095
87° 00′	99862953475457 4
86° 00′	99756405025982 4
85° 00′	99619469809174 0
84° 00′	99452189536813 5
83° 00′	99254615164132 3
82° 00′	99026806874157 3
81° 00′	98480775301222 0
81° 00′	98768834059514 3 7 7 2 7 2 true
79° 00′	98162718344766 1
78° 00′	97814760073894 7
77° 00′	97437006477773700
76° 00′	97029572627601 34
75° 00′	96592582628906 8 true so far
74° 00′	96126169593833 56
73° 00′	95630475595516 56
72° 00′	95105651629001 16 5 5 5 5 76 true
71° 00′	94551857559931 8
70° 00′	93969262078 58
69° 00′	93358042649716
68° 00′	92718385456672
67° 00′	92050485395191 1

Arch.	Sines	
24° 00	40673664307598	
25 00	42261826174070	
26 00	43837114678908 5	
27 00	45399049972343	
28 00	46947156283593 3	
29 00	48480962024634 5	
30° 00	50000000000000	
31° 00	51503807491006 3	
32° 00	52991926423261	
33° 00	54463903503223 1	
34° 00	55919290347073 9	
35° 00	57357643635104 0	43 3207 true
36 00	58778525229239 5	
37 00	60181502401815 7	
38 00	61566147532555 0	
39 00	62932039104976 1	
40 00	64278760968643	
41 00	65604599028990 5 12	
42 00	66913060634481 0	
43 00	68199836009567 32	
44 00	69465837045900 9	
45 00	70710678118654 8	true so far

Sit $r=1$

tum $\sin.10^\circ = ,17364817766690790964$

chord. $20^\circ = x$ & $r=1$

tum $x^3=3x-1$

& $x = ,34729635533381581928$ exact so far

Arches		Sines
66	00	9135451576424558
65	00	9063077870366 4
64	00	8987940462991623
63	00	8910065242083 00
62	00	8829475928518 76
61	00	8746197071394 10
60	00	8660254037844438 true
59	00	8571673007021 26
58	00	8480480961493 66
57	00	8386705679354 90
56	00	8290375625550445
55	00	8191520442889 80
54	00	8090169943748248 true 3 so far
53	00	7986355095478 21
52	00	7880107536067 8
51	00	7771459614570 2
50	00	7660444431 190
49	00	7547095802722765
48	00	7431448254914 41
47	00	7313537016034 17
46	00	7193398003386 63
45	00	7071067811865 48

As Radius: to double the Sine of any arch :: So is the Sine of that arch : to the Sum of the Radius and Sine of another arch having the Same common differen hence the rectangle of half the radius and the Sum of the Radius & Sine of any arch, is equal to the Square of the Sine of middle arch between the arch first taken, & the Radius.

In a ranck of equal differing arches the Sine of any arch in that ranck: Shall be to the Sum of the Sines of any two arches equally remote from it on each Side :: as the Sine of any other arch in the Same ranck : to the Sum of the Sines of the two arches next to it on each Side, having the Same common difference. i.e. $S.10^{\circ} : S.30^{\circ}+S.10^{\circ} :: S.30^{\circ} : S.20^{\circ}+S.40^{\circ}$.

1. As Radius: to the Co-Sine of the arch of difference :: So is the Sine of the middle arch : to half the Sum of the Sines of the extream arches.
2. As the Radius : to the Sine of the arch of difference :: So is the Co-Sine of the middle arch : to the half difference of the Sines of the Said extream arches.

Now the half difference of those Sines added to their half Sum, gives the Sine of the greater but Subtracted, leaves the Sine of the lesser of those extream arches.

Or the whole difference added to the Sine of the lesser makes the greater: or Subtracted from the Sine of the greater, leaves the Sine of the lesser, of of the extream arches.

If to the Sine of an arch less than 60°, the Sine of its defect be added, the Sum will be the Sine of another arch as much exceeding 60° as the first was defective.

As the Co-Sine of an arch, to the right Sine :: So is Radius, to the tangent of the same arch.

As the Cosine of an arch: to the R. :: So is the R.: to the Secant of the same arch.

The Circumference of the Circle whose Radius is, 1, is

6,2831853071795859

An arch of 30° = 0,5235987759829 8

an arch of 10° = 0,1745329251994 3

an arch of 01° = 0,0174532925199 43

an arch of $10'$ = 0,0029088820866 6

an arch of $01'$ = 0,0002908882086 65

The arch of 01 q. = 0,(7)8461594993 74 52.38

The arch of $01'$ C. = 0,(10)2461378210 14

The arch of $10'$ q. = 0,(5)8461594993 74

The arch of $10'$ C. = 0,(7)2461378210 14

The arch of 01° q. = 0,0003046174197867

The arch of 01° C. = 0,(5)5316576935 2

The arch of 10° q. = 0,(1)3046174197867

The arch of 10° C = 0,(2)5316576935 2

The arch of 10^{14} = 0,(10)7159858983 8

The arch of 10^{16} = 0,(15)6058382693 3

The arch of 10^{13} = 0,(12)2082718554 06

The arch of 30^{02} =, 2741556178074

The arch of 30^{03} =, 1435475725

The arch of 30^{05} =, 0,3935

The arch of 01^{04} =, (7)9279177242 0

The arch of 01^{05} =, (8)1619521947 64

The arch of 01^{06} =, (10)2826599029 4

The arch of $30^{04} = ,07\,5161335669$

The arch of $01^{07} = ,(12)\,4933345947$

The arch of $01^{08} = ,(14)\,8610312941$

The arch of $01^{09} = ,(15)\,1502683114$

The arch of $01^{10} = ,(17)\,2622676795$

The arch of $01^{11} = ,(19)\,4577743452.88$

$$y = y + \frac{y^3}{6} + \frac{3y^5}{40} + \frac{5y^7}{112} + \frac{35y^9}{1152} + \frac{63y^{11}}{2816} + \frac{231y^{13}}{13312} + \frac{1011y^{15}}{71680}$$

Let Radius be equal to unity; & v be equal to any arch, and y, the Sine of that arch, then

$$y = v - \frac{v^3}{6} + \frac{v^5}{120} - \frac{v^7}{5040} + \frac{v^9}{362880} - \frac{v^{11}}{39916800} + \frac{v^{13}}{479001600}$$

and the cosine of the arch, v, is equal to

$$-\frac{v^2}{2} + \frac{v^4}{24} - \frac{v^6}{720} + \frac{v^8}{40320} - \frac{v^{10}}{3628800} \text{ \&c.}$$

The times of the vibrations of pendulums, are to the times of perpendicular descent thro' half the length of the pendulum, as the Circumference of a Circle to the Diameter

Pendulum Royal movement.

8)96(12
8)64(8
8)60(7½
30

	Periods Days	h.	′	″	mean Dist.
Saturn.	10579	6	36	16	953800
Jupiter	4332	12	20	35	520110
Mars	686	23	27	30	152369
Earth	365	6	9	30	100000
Venus	224	16	49	24	72333
Mercury	87	23	15	53	38710

Boston November 10th 1736

I have been quite uneasy, that I have not had an opertunity of Converfing with you for So long a time; You remember I believe tho I told you the laft time you Saw me at your fa=thers that I Should not wait on you again for four or five weeks and I gave you my rea=fons for it. I went to Barnftable & Marfhfields twice Since ~~but you happened to~~ on purpofe to Spe a few hours in your Company, but you hap=pened once to be gone to Barnftable & once to Boftom. I was in hopes to have met with you at Boftom, but you I perceive left it on fryday & we got in the Sabbath follo=ing. I expect that people talk very much of my going to See ct. D. two or three times Since I Saw you; & efpecially becaufe ~~She~~ he came to Boftom in the Same veffel that I did tis much if the did not Suspect that we intended to be married here privately: but for the reft of the world I care not, Since I am Satiffied you know better than to believe any thing of it If you dont I am very Sorry; and I defire yo to confider my whole behaviour toward you at al times, efpecially at Dr. Doncan's laft Spring when She & you were both together. it is true I never difcourfed with you about mar=riage, for which I have Since been very Sorry I have always been plain-hearted faithful & tru to you, & have endeavoured by my actions mo than by my word to Show you that I greatly refpected you: and the love I have for you is not founded on imaginary perfections, formed by my own fond fancy: but I value you as a perfon of ingenuity as well as of an humour to me at leaft very agreable, & becaufe I have always found you faithful & true: & in particular becaufe I believe you to be a Sincere friend to me; and I muft gratefully acknowledge your kindnefs to me. & Shall re=member it as long as I live. I intend to See you the firft convenient opertunity. But if I Should abroad as I believe I Shall, and any bad

bad accident should happen, I hope you will be so wise as not to bestow your self on an undeserving person or one who is unsensible of your merrit.

I was
Having not long since been at Chatham
and had some conversation with one of your
parish (Mr. ——— by name) who I perceived is a
little inclining to some principles, which are
not counted good, as that the actions of men
are in their own power, and that even the
length of mens lives and time of their death
is not fixt by any determinate purpose of
God, but that they may, and do depend on
their actions which they may either perform or
forbear performing. And now for the Sake
of ~~Spreading~~ the truth, and preserving
Mr. ——— in particular (for whom I have a great
respect) in the right way of thinking, I have
employd a few hours in gathering together the
chief of the forcible arguments I can think of my
Self or collect from others the most able
writers against those who deny a chain of
causes & effects in the rational world, or that
the actions of men are brought to pass by
any fix'd predetermination or decree of God.
And I thought it suitable first to submit what
I have written, to your Superior Judgment;
and desire you if it may be without too
great a trespass on your better Spent time
to look over the inclosed, and make any addi-
which you think may be of Service to the cause
and if I dare to ask so great a favour of
you, I would desire you to transcribe it, &
Send it to him not letting him know of any
other person concern'd in it but your Self
for I am Sensible of the great value he has
for you; and therefore whatever comes from
you will have so much the greater weight w^n
from one he has a mean esteem of, even one
who am your very humble Servant.

Suppose two men Set out to Gether & the first day A travels 30 mile & B 34 then el every Day travels So far as B did ye Day before and B more then A in ye Same proportion as ye first Day (that is as 34 to 30) how Long before the Distance Betwen them will be 30 mile

If my Questions are improper or do nt admit of an answr by ye Rules of Art I do not Desire any regard Should be paid to them and none is Due to ye Auther

John Ward

$$a+\frac{b}{2}=b+\frac{c}{3}=c+\frac{a}{4}=100$$

$$2a+b=2b+\frac{2c}{3}=2c+\frac{2a}{4}=200$$

$$6a+3b=6b+2c=6c+\frac{6a}{4}=600$$

$$24a+12b=24b+8c=24c+6a=2400$$

Sum of value of all be found if $aa+a=84$

$$a^2+a+\frac{1}{4}=84+\frac{1}{4}$$

$$a+\frac{1}{2}=\sqrt{84+\frac{1}{4}}$$

$$a=\sqrt{84+\frac{1}{4}}-\frac{1}{2}$$

3a

$$24c=2400-6a$$
$$24a=2400-12b$$
$$24b=2400-8c$$

$$12b=2400-24a$$
$$24b=2400-8c$$
$$24c=2400-6a$$

9,178
8,67888=a.
84,25(9,178
81
181 325
1814
18347 44400
12789
1611

2 : 3 : 6
1 : 1 : 8
1 : 1 : 10

London in —

— Connecticut 41. Deg 25 Minuits North

and 1d. 45 Min: West from the royal

Observatory at Greenwich —

John Adams's
Travels
1761

Hartford April 11th 1761

℞ Empl: Diacalbani
Galb: Colat. . . . ℥ij
Cera: Flavum . . . ℥ij
Tereb: Commun. . . ℥j
Ex his: Empl: ft: &
Bilule Iterica.

℞ Sapo. Venet. . . ℥j
Gum: Ammon: Solut: vinegar ℥j
Croc: Anglican. . ℥j
Ol: Juniperi gut n° 40
Pul Cyprum . . ℥j
— al Martis . . . ℥iij

℞ Assa foetida . . . ℥iij
— Castor . . . . . ℥ij
Gum: Mastic . . . ℥ij
— Camph . . . ℥j
Tereb: Venet 2: s: M: f: M: B:
a Dose is 5ij to be repeated
at small intervals Ex: h:
℔ 1112

Pilulæ Cathartic.

℞ Aloes: Communis ---- ʒij
Sapo: Venet ---- ʒj
Ol: Propiet q.s.
Sol. Bals: Capevi ʒj

℞ Antyhyst: Elect. —
Pul Castor ---- ʒj
---: Myrrh ---- ʒss
Ens: Veneris ---- ʒj
Confect. Cydonior ʒj

℞ Elect. Incras. —
Mucil: Pul: ʒj
Crocus Martis Ast. ʒj
Sanguis Dracon ʒj
Hom Pul -- ʒj
Confect. Cydonior ʒj

℞ Elect: Rosat: ——

Pul: Coral: rub: ..... ℥ß
Occul: Cancror: ppt: .. ℥ß
Pul: Arom: ..... ℈ii
Confect Cydonior .. ℥4
Acidulab it w.t Elix: Vitriol

Elect: Alterat

Cinnab: Antim .. ℈j
Ethiops: Mineral ℈iij
Gum: Guiacaci .. ℥ß
Confect: Cydonior .. ℥4

Elect: Pectorale

Pul: Glycirhiz ..... ℥j
... Emulle Camph .. ℥iij
Flor: Lylph ..... ℈iij
Mel: Dulcis q: s: M: fiat

℞ Empl Mamillare

Sperma Ceti ... ℥j
Cera Alb ... ℥ij
Galb Colat ... ℥ß

Ex his Empl ℞ 8t

Pil: Paregorice

℞ g.m Opii ... ℥j gt 4
g.m Myrrhe ... ℥j
Sapo. Venet ... ℥j
Liq.d Laud: Q.t S. M. f.
Pils n.o 128

℞ Aquæ Cinnam ... ℥ij
Theriacal ... ℥j
Brioni ... ℥j
Peonii ... ℥j
Saccharat Alb: ... ℥iij
Ol Anis Gutti n.o 60
Cloves ... n.o 30

Ex his Card: Sulph
post Cast

§1189. Sweat is promoted chiefly (1) by plentiful drinking of watery Liquors very warm; (2) by the Use of fermented Acids, Vinegars; (3) Alcalies with warm water

Diaphor Antimony
Sulph: of Antimony
Bezoar Mineral
Aurum: Diaphor:

(5) By the Use of Aromatics abounding with an acrid & subtil Stimulus, such as Absinthium, Ageratum, Asparagus, Anisum, Angelica, Asarum diu coctum, Betonica, Carlina, Carduus benedictus, Centaurium minus, Crocus, Chamämelum, Capilli Veneris, China, Dictamnus creticus, D. Albus, Galenga, Gentiana, Hyssopus, Mentha, Pulegium,

§1201. To suppress a too copious Salivation: Let a Decoct of Mallows & Liquorish in Milk & Water; be Drank plentifully

2. By soft and oily Emulsions, with the Additions of Anodines and Diacodium, or Opium prudently used

3 By Cathartics in small Dos often repeted

§1208 Vomiting is allayed by some mild oily Draughts with Opiates, Aromatics, grateful & corroborating Acid, taken internaly or applied externaly.

Fresh expressed Oil of Sweet Alm ond gives present Relief; but Opium with Vinegar hardly ever fails.

The last Remedy is Cupping-glasses applied:

§ 1216 Violent Purging is suppressed and moderated, by the Use of soft oily Medicines & Emulsions, by Acids, Astringents, Opiates & Spirituous Liquors, or lastly, by making a Revulsion to other Parts.

Especially in this Case, do I trust to a Clyster well charged with Theriaca. with the same Electuary spread in the form of a Plaster, & applied to the whole Abdomen.

§ 1222 The urinary Evacuation is excited, by Sea-Salt Sal-Gem, Nitre Borax Alum Sal Ammoniacum Sour Milk: Butter Milk: or sour Whey: By the Milder Acids of Vegitables, as juice of Oranges, Citrons, Lemons, Currants, Elder-berries: & thin wines, as Rennish & Mosselle

By acid Spirits, as of Vinegar, Nitre
common Salt, Sulpher, Alom &
Vitriol simple or compound: or
dulcified; to wch add the Sal-
-succin: Those of the vegetable kin
as Smallage, Asarabaca bark,
Asparagus, bitter Almonds, Chervil
Daucus, Eringo, Maudlin, Gromwe
Peach-kernels, Onions, Parsley, pim-
pernel, Butcher's-broom, Saxifra
&c: water Charged wt Sal-Gem
or vitriolated Tartar, is a great
Diuretic. the whey of milk na
wt Cream of Tartar is a good diu
Juice of Lemon Lately expresd an
with Kenyh wine forms a good
Diuret:

224 The urinary Discharge i
Suppressed or moderated,
By the use of the more viscid &
Gelatinous Emulsions.

2. By the adjunct Use of astringent and Corroberating Medicines
3. by the use of Opiates. ——
4 By determining the Humours to other Parts, and more especially by exciting & continuing a Sweat for some time by Exercise or Sudorific Medicines.

Those who are troubled with a Diabetes are not easily cured without sweating in a Stove or hot House.

§ 1225 The Evacuation of blood from the Womb, is excited by those Medicines, which, Determine the blood plentifully to the Uterus, as Fomentations, Baths, & Washes for the Feet & Legs; Frictions frequently repeated upon the Feet & Legs, Thighs & hypogastric Regions; Cupping-glasses applied to the Thighs and upper Parts of the Legs; by bleedin

in the Veins of the Feet: & by the Application of Plasters of the fœtid Gums to the Navel, Thighs & Legs.

2 By the Use of aperient Medicines which open & relax the uterine Vessels as Vapours, Baths, Fomentations & Injections; internal Medicines of the same kind, as Birthwort, Mugwort, Calamint, Motherwort, Ground-pine, Dittany, Lovage, Marjoram, white Hoarhound, Feverfew, Mint, Pennyroyal, Rosemary, Rue, Savin, Savory, Tansy, the fœtid Gums: with Aloes, Myrrh, Saffron, Borax, Steel, Amber, volatile alcalin Salts, & distilled aromatic Oil.

§1227 The menstrual Discharge suppressed or moderated when profuse, by cupping-Glasses applied to the Breasts.

2 By astringing the Vessels

3 By the Use of Opiates

§. 1252. Too profuse a Discharge of blood from injured Arteries or Large Veins, is quieted by Compression, Ligature, burning of the Vessels, Inspissation, ~~Ligature Burning~~ of the Fluids, & Contraction of the Solids: for which Purposes Alcohol Vini, and Spirit of Turpentine applied hot, are recommended as the chief.

℞ Rad: Tormentil: . . ℥vi
Cort Granat: . . . ℥ij
Ferr . . . . ℥iij
Cinnam . . . . ℥j
Terra: Japon: . . . . ℥ij
Rad: Zedoar: . . . . ℥j
Incisis & Contusis M: f
Rect Decoct: for Mrs Drake
winefor

4 Pul Mucilag ℥ss
Croc: Martis aft: ℥iij
Pul Arom: ℥ij
Coral: Rub - - ℥ij
Conf: Rosar: ℥j
M: f: Elect for Mrs Drake
76. 1st 1761

Rad: Gentian ℥iij
Galang ℥ij
Zedor: - - - ℥ij
Curcum - - - ℥iij
Bacc: Laur: ℥ß
Sem Carm ℥ß
Flos: Camomil p: j
Steep in two Quarts of wine

℞ Aloes Hepat. — August 4th 1761
℥ss
Pul: Myrrha — ℥ss
Liquid: Laud:
Sals Peruan Lt: S:
M: f: Pils of 5ss Each
This from Doct Hall for
Hist: & Colica Patients

Pul: Stomat: Ex Dr Hall
℞ Pul Genti — ℥j
Curcume ℥j
Sal Mirab Glaub ℥j
Gum Myrrh ℥j
℥iv

Sal Ammoniac or Sea Salt ℥j
Aqua Font. . . . . ℔i ¼
Vini. . . . . ℥5
Vineger. . . . . ℥ij
A potus for Bruises &c
Van Swieten Comentary
vol 3d page 124 or in Lue
of the above the Urine of
a Healthy Person mix with a
small Quantity of vineger
Composes a Cometation of y
like nature page 125
Take inwardly at the same time
an Infusion of Scordium, rue,
horehound, Sanders Nitre,
Honey &c & the Juice of Onion
Roots, the above Medecines
to be us'd after V. S. & purging
with Linat wes mix'd with Nitre
Evening & the same time
Fricktions

Spirituous liquors may be of great use to allay sweats from a too thin state of the fluids and a relaxation of the cutaneous vessels.

Malaga wine 5or six spoonfuls for a dose

An Infusion of sage in wine Take 5 spoonfuls night & morning

the same in spt of wine take two spoonfuls night & Morning. (which van Swieten says never fails.) vol 6th page 366

Pul Mucil: ℥ß
Croc Mart Aff ℥ij
Aromat ℥j
Ext: Cinet ℥ij
Gm Myrrhæ ℥ij
Aloes ℥j
Confect Cydonior ℥ß
M fiat
Hor: Decub: Hannah Lyman
Sept 8th 1764.
℞ Aloes succot ℥ß
Cabal ℥ij
Cort Cinnam ℥ß
Cort Winteran ℥ß
Vom Cardamom ℥ß
Croc Anglic
Americ ℥ß
Sal Absin ℥j
Ex vin Hisp Picra fiat ℥ß

The Cure of the Lues Venerea by the Mercurius Corrosivus Sublimatus was first brought into regular practise by y^e Learned Baron Van Swieten, Physician to the Court of Vienna.

Dissolve 19 gr^s of y^e ℔ in ℥ij of Brandy the Dose from ℥ß to ℥j of the Solut^n Night & Morning. The Quantity Ought to be Adjusted According to the Strength of the Patient or Virulence of the Disease.

The Operation is commonly by Sweat, Or urine, when the medicine proves most successful; The Solution is to be Continued as long as any of the Symtoms remain. During ye. cure, Let the patient use a low spare diet, Drink plenty of Barly Water with a little Milk, or some such Diluting Liquor:

Medical Observations & Inquiries vol. 1st page 365

J. C. 19 years of Age, had two buboes
a phymosis & a virulent running
As y^e tumours were not far advanced
I began to give him the solution
as soon as he applied to me, which
was on y^e 25 of Decemb^r: he took two
spoonfulls night & morning. On y^e 2d
of January, y^e Buboes were quite
dispersed, the phimosis some what
reduced, but the running still cont-
-nued of a bad colour. On the 8th, the
phymosis was so much better that
he could uncover the glans. On
the 16th, he was intirely free from
any remains of the disease, except
a small running which was clear
and ropey I gave him nomore of
the solution, but made him inject
the following mixture, twice a day
℞ g^m Arabic. ℥i. solve in Aqua C.
℥ij Col. & adde Calomela ℈ß Pul. e.
cerus. t. comp. ℈i. M. fiat injectio.

After using this for three or four days the Gleet stopt. He made all along a great deal of urine, & sweated a nights.

I believe I may venture to pronounce, that the Baron Vanswieten's method of treating the Lues Venerea is far preferable to that by salivation; whether we consider the speediness, the safety, or the easiness of the course, and the condition of the Body after the cure. And with regard to other mercurial alteratives, though I think this medicine cannot be called such, as having almost always some sensible operation, I must own, that after having tried several, & hearing the accounts of others, who have had a good deal of this kind of practice, I have found none that I could so much confide in as in the sub-

Sublimate used in this manner
A few of the men were puzd gent
by the solution, in the beginning
of the course; but that evacuation
never continued after the third, o
fourth day the chief operation
being by urine, & sweating a
Nights. The diuretic & sudorific
qualities were in proportion to
the dose. A few were a little
qualmish with their morning do
but this last circumstance only
happened when I first began t
give the medicine. When I dou
bled the dose, viz. by giving the two
spoonfuls twice a day, I did not fin
that the qualmishness increasd in
proportion to the Quantity.

Their diet was generally as follows
for breakfast water-gruel; for
dinner, broth, with a little boil
meat, not above 6z in quantity

for supper, milk porridge. Barly water to Drink at pleasure; and the patients were desired to use from one Quart to two Every day: No malt liquor was allowed: No preperation was made, if the patients were not feverish, & had no inflammatory symtom; but in these circumstance or in that of a phymosis, we found it necessary to begin w. bleeding, but not to purge at all.

As for the chirurgical part, it was very simple. The chief point requisite, was to keep the sores clean, & to wash them with the following mixture.

℞ Merc. dulc. subtl. levig. ʒi
Pulv. cerus. Comp. ℥ij. Aqua.
Calcis ℥ij. M.

With this I used to wash the ulcers two or three times a day: ℣, in the

Case of a phymosis the same was injected betwixt the prepuce & glans with a syringe. When I could get at the part affected, I freely applied some lint with a little mercurial ointment.

If the phymosis is so bad, that, after bleeding and taking the medicines for some days, there is no appearance of the foreskin yielding, it may be presumed that the virulence of the sores within keeps up the inflammation; &, for that reason, it will very much hasten the cure to slit up the prepuce the whole length, to come at the ulcers which are to be cleansed & dressed in the manner directed. This operation is attended with no inconvenience; for if the small artery, continued from the upper part of the penis is cut, the cure will be

the more speedy, by the plentiful bleeding of the wound.

But if the phymosis has continued so long, as that the prepuce has become thick & scirrhous, it will be in vain to expect any resolution of this induration, or the cure of the disease, whilst the gland may be supposed to be in an ulcerous state. In which case, the whole of the prepuce must be cut off; for a simple incision will not be sufficient.

In cases attended with any considerable inflammation, we found one or more bleedings necessary, before we gave the medicine; but except this evacuation, and the application of a bread & milk poultice, we did nothing further to reduce any inflammation.

Again, after the washing the sores

of the penis (whether shankers, ulcers, or excoriations) with the lotion already described, nothing was applied to them but dry lint. We used no other dressing for the buboes, & I never knew such a number heal so kindly.

Except the Lunar caustic for warts very foul sores, & fungous excrescences, I do not recollect y^t any other external medicine was applied.

Ex a Letter written by D^r Abraham Gordon, Surgeon Major to the 3^d Regt: of foot, commanded by Col^l Howard, wrote Feb: 18^th 1757

Says D^r Pringle I have visited upwards of 60 patients, they all was recovered by y^e above medicines, except three or four M^r Observat^n 387

Sanitifera.

℞ Salt of Steel (or common Copperas) dried before a fire till white, then beat into powder & searced through a tiffany sieve one ounce, of Creamtart Jallap-root, Senna leaves, & beat ginger, one ounce; of Chymical oil of cloves twelve drops, Syrup of orange-peels, as much as will bring it to the consistance of an Electuary.

A Stomatic medicine of great use, and yet the expence small. I have always observed good effect result from the combination of purgative medicines with chalybeates, & have experienced their —

admirable success both in infant and adult (upon repeated trials) in the five subsequent cases, used with perseverance.

1. Convulsions in children, who, by reason of their difficult breeding of teeth, or, being burthened with sharper humors, are troubled with gripings & green stools, have restless nights, starts in their sleep, the sure forerunners of convulsive fits

2. The whooping cough, than which no one distemper to which children are subject, is more dangerous, frightful, or more difficult to cure, when it is deep-rooted, - besides a long perseverance in this, it would

be convenient, after every coughing fit to take a teaspoonful of Bals Syrup.

3. Worms. It is of singular service in the most obstinate & stubborn worm cases, for it fails not to expel worms & grubs, & that kind called Ascarides, which causes extreme itching.

4. Night intermitents, to which children are very subject, & which will be much sooner cured by this medicine, than by the bark; for the former actually reaches & weares away the causes, but the bark pens it up, and, by curing only while such restriction continues, gives room for a return w. much greater aggravation.

5. For shortness of breath, in such as are pale-looking, wan, & sickly, loath wholesome victuals, yet long after trash; want breath upon going up stairs, have a palpitation at their heart, pain in their head & stomach, & are indolent & averse to all exercise. To take the quantity of a nutmeg night & morning for six months.

In the morning to be took fasting. At night, when going to bed, drinking after it either half a wine, or half ale seasoned with ginger.

Using much exercise, & guarding against cold, & forbearing to drink Milk.

The Dose to infants is the quantity of a coffee-berry; to children a small knife point full night & morning.

From the Universal Magazine
for July 1760 put these by
Edward Watkinson

℞ Fol Sena Rad Rhei
opt aa ℥i tinct mon Crus
well levigated ℥ß
Sem Cardam min ℥i
Grana Paradyse
Piper Long aa ℥ß
Elect Simplic ℥ß
M f Pulvis — Dose
a Quantity of a
Chestnut or of Cafe
Requisite
Dr Dolbt Dec 3 1760

℞ Antyhyst
Pulv. Gabbolat ʒij.
Ammon ʒi
Sagapen ʒij
Myrrha ʒs
Castor Zibet aa gr. vj
Zinzib ʒij
Cinnam. Lect. q.s.
f. B. ad Pil. xxx

℞ Aq. Menth. ℥ij
Camphor. ʒi
Alkerm. ℥ij
Pulv. Gabbolat ʒij
Mastich ʒij
Myrrh. ʒs
Castor Zibet aa gr. vj
Zinzib.

℔ [illegible] Zinzib. ℔ß
Aloes Succotrina ℔ß
Gm Myrrh ... ℥i
Opii ... ℈ß
Sabo Venet ... ℥i
Cort Cinnam 2oz
Ft Bals Gmo ℥ß Junip
Ft. S. S. M. ℥ß
Capt Wm Gleadow Rice
{16 Dec 1765}

℔ Aloes Succot
Cabalin
Sapo venet. . . aa ℥ij
G.m Myrrhæ . . . . ℥j
— Opii
Sem Cubeba
Cardamom aa ℥ß —
Croc Anglic ℥j
Cum ℥ß Bals Peru
M Pill
Fiat y Collick Aug.t 15.th 1767

℞ Rad.ᵗ Rhei Ind. ℥ij
Cream Tart ... ℥ij
Linat Elect. ℥6
Sy.ᵖ D. Rham. Cath. ℥ij/℥ij
M.f. Elect. ℥x ℔ol
Titus Homer Esq.ʳ —
30ᵗʰ March 1769 —

℞ Pil Cocciae —
Aloes Hepat ℥ij
Scamony
Colocynth aa ℥ß
Sapo Hispan ℥ß
Ol Caryophyll ℥ij.
Sy. Bals. ℥ij fac Pil.

79
March 9ᵗʰ —

℞ ℈ Guiajaci
Sapon Venetor ana ℥ij
Calamonch
℈ Comp. ana ℥j
Tartar Emet ℥ß
M. ft. ℔ j pro Pils

℞ Cast Ven ℥j
Valer Silvest ℥ß
Ol Caryophil ℥ß
M. dis ℔ fut. pil Elect

One of the above pils was directed to be taken & increased one pil every night for a month purging with Salts at proper

Intervals. The Electuary
was ordered to be taken
the bigness of a Chestnut
at 11 Clock forenoon
& at 4 Oclock afternoon
Elix of vitriol was Ordered
to be abstained from during
the above course
Directed for an Asthma
to Mr Lewis by Doct
Thomas & Josh Young
Albany Middleton
Octob 20th 1773

He calls the above a
Rheumat C.C. ——

New Method of Inoculation

1 The night before you inoculate, give a few grains of Calomel, with a like quantity of Antimon: Diaphor: non Lotum, proportioning the quantity of Calomel to the constitution of your patient from 4 grains to 10 for a grown person, and from 1 to 3 for a child to be made up into a bolus or small pil. with what Salts best. —

2 The next morning purge with the Pulvis Cornachini; —
repeat the bolus or pil 3 times that is, once every other night after Inoculation, on the 5th day give a dose of Boerhaaves Sulph: Aurati: Antimon: about 4 grain of it wt 2 or 3 grains of Calomel, made into a pil will Operate both as a vomit & purge at the same time —

In the intermediate days give
2 or 3 papers of the following powder.
℞ Antim Diaphor ---10 gr.
Sal Prunel ---- 6 gr.
Calomel ---- 1 gr.
M: F: Pulvis pro Dosi

These powders are to be continued until the Variolus or Small pox fever is over, & while the fever is high, let your patients drink be whey made w.th Cream of Tart. and those y.t are of a full habit, should be bled once or twice with.in the first eight days, & must abstain from all Spirituous liquors, as well as from meats of all kinds, broth, salt & butter.

Ex Boston paper January 26: 1761

A nother method of Inoculatio

℞ --- Calomel -- ℥ij
Sulph: Auriat: Antim ℥j
Solut: g: Arabic q: s: for pils

℞ Stib: Nitrat -- ℥j
Cream: Tart -- ℥j
Sal Poly Chrest. ℥j
Flos: Sulph -- ℥j
30 gr of this pulvis is a dose for an adult.

℞ Stib: Nitrat. -- ℥j
Pul Salap ℥j
-- Scammony ℥j
Cremor Tart ℥j
30 gr of this is a dose

The day before Inoculation, give a dose of the purging pul with 5ij of Mus Dulcis, The night after Inoculation, give a Dose of the above pil w- is 10 gr & repeat it three nights successively. The

The morning after the third pill, give a second purge; after which repeat the pills 2 or three nights, and then the purge again.
Every morning, including the day of Inoculation, give a dose of the refrigerant powder (Except the day the purges are administered) continuing them till the eruption.
Bleeding is good for those that are of a full habit of body, within the first eight Days, viz. on or about the Day of Inoculation & the day you expect to be seized with the fever, which is generally the eighth or ninth; and also in ordering to abstain entirely from animal food, and all kinds of oil or greasy substances, salt, spice or spirituous liquors, great fatigue or violent exercise, together with all intense thinking, but vegitables & acids may be used plentifully. They

they should not be closely confined except when the air is cold or moist: and when the variolous fever comes on, they should be kept rather cool than hot. Let their drinks be cooling, acescent & laxative, especially Tartar Whey. —

If their mouths & throats should be sore, give them a tea spoonfull of Flor: Sulph: instead of the refrigerant powder for two or three times. —

As soon as they begin to complain, they should bathe their feet in warm water, for 10 or 12 minutes, morning & evening (till the eruption is compleat) & if the head is much affected bleed them in the arm or foot, & apply emolient poultices of bread & milk, & a little oil or hogs lard to the feet. —

If costive in the eruptive fever, especialy if delirious, or have fits,

give an opening clyster once or twice a day, till those symptoms are removed. During the eruptive fever they may sit in bed if they chuse it, or lie on the bed, & lightly cloathed, drinking plentifully of barley Water, Sage & Balm Tea, or Toast & water, with Tamarinds: & when filling, let their use, Milk & Water, panada, Sago, Gruel, Puddings, Greens & Roots. if they are a little costive while the pock is filling, it is no great matter, and may generally be prevented by drinking warm Small Beer, eating a roasted Apple, or a few Tamarinds now & then; but if very costive at the turn of the pock, an opning clyster of water gruel or milk, it may be sweetned with molasses & have a little oil in it, will be proper every day or two. as soon as the pocks are dry they should be purged three or four times, at two or

& three days distance, with the same purges as at first.

Ex Boston paper

℞ for Black Ink
Galls ℥ss Alepo ℔ss
Copperas ℥ss Gr Arab
℥ss
Allum ℥ss
Rain Water ℔i
Ex Fisher April 22nd
1773

℞
Pul Rhei Rad 3i
Cream Tart
Tal Limæ aa 3ij
Elect Limitæ 3s
M. f. Pharm. Catk. q. s. ut f. l.
A copy of this given to
Capt Hadsworth to send to
the Head Quarters
Dec 25 1769

℞ Gum Myrrh
Cinnamon Macis Cinnam
Cort Angelic aa 3i
Succin aut China rasæ 3i
Aloes Hepat 3ß M f Pul
Pulv Pulvis

Pamphlet

Jn.° Osborn's Decl.

April y.e 12.th

$x^n = ABC$ &c. is $nox^{n-1} + \frac{n^2-n}{2} oox^{n-2} +$ &c.
$= BDFC + CFH$. and only the first members on each side being retained, $nox^{n-1} = BDFC$: & dividing by o or BD, $nx^{n-1} = BC$. None if this conclusion be true, it is absolutely necessary
$\frac{nn-n}{2} oox^{n-2} +$ &c. $= CFH$ the Curvilinear Space.

Comparing the homologous or correspondent members on both sides, we find that as the first member of the expression, is the expression of the given area, so the second member of the expression will express the Rectangle or Second member of the Geometrical quantity; and the third, containing the powers of the increment, will express the curvilinear Space, or third member of the Geometrical quantity.

Poor little, pretty, fluttering thing,
Muſt we no longer live together?
And doſt thou prune thy trembling wing
To take thy flight, thou knowſt not whither.

Thy humourſome vein thy pleaſing folly,
Lyes all neglected all forgot,
And penſive, wavering, Melancholly,
Thou dreadſt, and hopeſt, thou knowſt not what.

Interpone tuis interdum gaudia curis
ut possis animo quemvis sufferre laborem.

Hoc Distichon clarissimi Catonis, nobis
Optimum adhibet Concilium, & certé
æstimandi dignum, ad studium & laborem
animi, interdum aliquo ludo aut latitia
innocuo levandum. & etiam certi sumus
nihil magis ingenium acuere, gaudiis ali-
-quando curis interpositis. sed maxima
est hominum diversitas inclinationum:
Alii aliis ludis aut latitiis delectantur.
Alii pilâ palmaria ludendo, alii globum
ferreum rotando, & alii gaudiis implentur
dulcisonas avium inter silvas viridis frond-
-ibus umbrosas, Cantilenas audiendo.
Et aliorum maxime ingenium acuitur,
& gaudiis impletur, grandia & faceta
Virgilii, Horatii, aut Miltoni, aut alii
Cujusvis eximii poeta carmina legen-
-do; & majorem credunt fructum capere
possumus vatum antiquorum lectiones, ad ~~tetam~~
-ea curarum solamen interdum studiis
interponendo & ad corporis salutem
pede libero tellurem pulsando, quam
in aliis ludis omnibus, quibus Juvenes
maxima ex parte temporis consumere
solent. at mihi videtur, carmina aliis
anteponere debent, ut Horatio, Tibur

Tibur reliquis civitatibus, ut Ode
Septimâ, libri primi, dulce canit.

Laudabunt alii claram Rodon, aut Mitylenen,
Aut Ephesum, bimaris-ve Corinthi
Mœnia, vel Baccho Thebas, vel Apollini Delphos
Insignes, aut Thessala Tempe.
Sunt quibus unum opus est, intacta Palladis urbem
Carmine perpetuo celebrare, et
Undique decerptam fronti preponere olivam.
Plurimus, in Junonis honorem,
Aptum dicet equis Argos, ditesque Mycenas.
Me nec tam patiens Lacedæmon,
Nec tam Larissa percussit campus opima
Quam domus Albunea resonantis,
Et præceps Anio, et Tiburni lucus, et uda
Mobilibus pomaria rivis.

Carissimus Johannes Osborn.
in optimæ fidei
Jan. 1. John Osborn

John Reed

Joseph Underwood ejus Declamationes compositas Johanne Osborn

Great God! whose power o'er heaven and earth presides,
whose eye surveys me, and whose wisdom guides,
Grant me that portion of content and rest,
That unknown peace, as health that suits me best;
Save me from all the guilt, and all the pain
That lust of pleasure brings, or thirst of gain,
In trial fix me, and in perils shade;
Guards most protect me, against my passions aide;
That sweet sensation, teach me to impart;
Transports to feel! — benevolence of heart;
Each home-felt joy, each publick duty send,
Make me, and give me all things, as a friend
But most protect, and guard me in a mind,
Not rashly bold, nor abjectly resign'd;
And oh! when Interest, or my virtue hides,
When error blinds, & prejudice misguides,
Alike thy grace, alike thy truth impart,
Beam on my soul, & triumph o'er my heart
Thy word, O God! my science and delight,
Taske of my day, and transport of my night;
There taught, that he, who suffers, is but try'd,
And he, who wanders, still may finde a guide;
Sanction with truth, reward with virtue join'd,
Life without end, & laws that reach the mind.
Thrice happy he, who such a guide can, take,
For God hath spoke, and God will not forsake.

Interpone tuis interdum Gaudia curis;
Ut possis animo quamvis sufferre laborem.

Hoc Distichon Clarissimi Catonis nobis optimum adhibet Consilium, et certè æstimandi dignum; ad studium et laborem animi, interdum aliquo ludo aut Lætitia innocuo levandum. Et etiam certi sumus, nihil magis ingenium acuit, quam diuis aliquando curis interpositis. Et cum vita mortalium nulla pars a curis exempta sit, lætos & contentos vivere debemus. Ut Horatius ~~facete~~ decimam sextâ libri primi Odarum; facetè descripsit.

Scandit æratas vitiosa naves
Cura: nec turmas equitum relinquit,
Ocior cervis, et agente nimbos
Ocior Euro.
Lætus in præsens animus, quod ultra est
Oderit curare, et amara Læto
Temperet Risu. Nihil est ab omni
Parte beatum.

Et maxima est hominum diversitas inclinationum; Alii aliis ludis aut lætitiis oblectantur: Exempli gratia; Alii pilâ ludere, alii pictis chartis & alea

ulea, alii globum ferreum rotando
oblectantur; alii gaudiis implentur dul-
cisonus avium inter lucos viridis fron-
dibus umbrosos, cantilenas audiendo.
Sed aliorum ingenium maxime acuitur
& gaudiis impletur, grandia & faceta
Virgilii, Miltoni, Buchanani & cujus-
libet eximii Poeta carmina legen-
do. Sed nos Scholares aliqua corporis
exercitatione, cum venatu vel aucupio,
ad salutem nostram servandam inter-
dum fungi ~~debet~~ oportet, (nam ut ex-
perientia docuit, otio indulgentibus va-
rii morbi incidunt) & nulla medicina
valitudini tantum conducit, ut Dry-
den his versibus bene indicat.

By Chace our long-liv'd Fathers earn'd their Food,
Toil Strung the Nerves, & purified the Blood:
But we, their Sons, a pamper'd Race of Men,
Are dwindled down to threescore years & ten:
Better to hunt in Fields for Health unbought,
Than fee the Doctor a poisonous Draught.
The wise for cure on exercise depend:
God never made his work for man to
mend.

I

Revolutiones Planetarum, naturaliter non perpetuo durabunt.

Motiones planetarum circulares vel potiùs ellipticas circà Solem Centrum, naturaliter non esse perpetuas, probandum est. Et motum hunc circularem duobus motibus compositum quorum alter quo curvæ revolutionum tangentè conatur progredi, & alter ad centrum gravitatis tendit, vobis valde notum esse nil dubitarem; et ut motus ad centrum tendens continuè eadem ratione, eadem distantia, agit. ut si motus prógressivus seu projectilis aliquo modo retardetur, tum motus ad centrum superábit motum centrifugum quem motum minuitur, diminuta velocitate progressûs, ita corpus quod movetur, ad centrum descendet & sic revolutio finita erit; Et ut aliquod medium sit per regiones planetarum diffusum, insignis illa Newtonus quod impedit motui illarum obstet, insignis ille Newtonus rationi consentaneum reddit. at si hoc medium negatur, Scimus omnes, lucem Solis, planetarum & Stellarum fixarum semper extra atmosphæris aliquando obscuris omne loco esse diffusam quod cujus resistentia tamen quam exigua sit attamen levissima curvatione ita motus earum impedit ut ad Solem descenderent. & ita cessaverint revolutiones

Stellæ tempore observationis nunquam sunt loco eodem quo nobis apparent.

Revolutiones Planetarum, naturaliter non perpetuò durabunt.

Possibile est, Stellas duralionem infinitam extitisse.

Non igitur Stellas animæ vis vivida torquet.

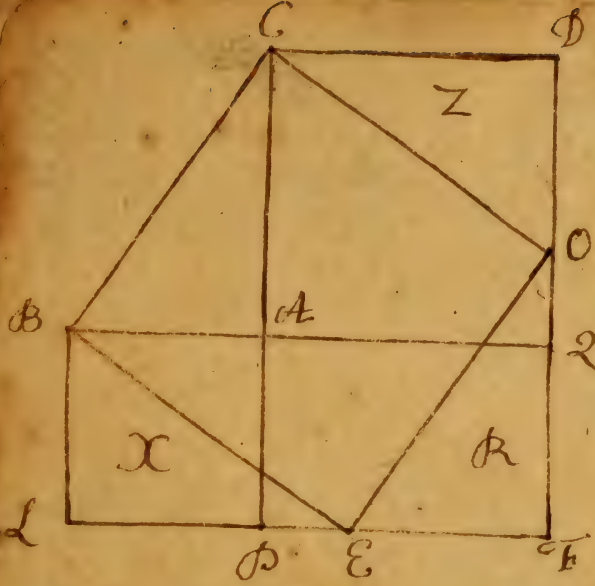
Mundus ultima Conflagratione non est annihilandus.

Quicquid est contra leges Naturæ notas et non a prophetis divinitùs admonitis prædictum, futurum esse, non credendum est. Est ut aliquod corpus, actione ignis annihiletur non est secundum Sed contrà leges Naturæ notas, experimentis abundè probatur; tanquam enim aliqua corpora, ex. gr. aqua actione ignis ex perceptione nostra evanescit; attamen non annihilatur Sed tantum forma et locus ejus mutatur; quod facile videtur aquam claudendo vasi undique occulto, nisi uno foramine parvo: cui vasi si ignis subjectus sit, statim, in eo aqua nulla est inventa; quam non esse annihilatam scimus, quia facile persentiamus ejus ex eo egressus.

Et propheta Sacris Scripturis (et nescimus alias prædictiones certas nisi quæ Sacris Scripturis continentur) cum ultimam conflagrationem prædicant, de annihilatione nullam faciunt mentionem.

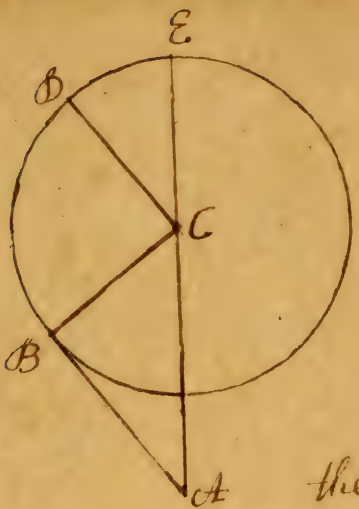
Et cùm, annihilatio sit contrà leges naturæ, et nulla mentio de ea a Sacris prophetis facta est; sequitur, nihill de annihilatione credendum est.

Decem. 9th. 1734



In the right angled triangle ABC; the Square made on the side BC is equal to the Square made on the Side BA & the Square made on the Side AC taken together.

Let the parallelogram L2 be compleated; the whole figure exceeds the Square on BC by the three triangles, X, Z, R, and exceeds also the Squares LA, & AD, by the triangle ABC, & the paralelogram P2: which excesses I say are equal; for Z is equall to ABC, the Side OC = BC, CD = AC, the angle D = BAC, and OCD = BCA: which is manifest by taking the common angle ACO; out of each of the two right angles BCO & ACD; therefore by Superimposition the whole triangles are equal: in like manner X, or R, is proved equal to ABC: and the paralellogram P2 to be double the triangle ABC: thus the excesses being proved equal, the remainders also will be equal: viz. the Square BC to the Square of AB & AC. 2 E.D. many Corollaries from hence are the 35th & 36th of the 3d Book [illegible] & 12 & 13 of 2d



Some of Euclids propositions demonstrated independently from the rest by Mr. Ash. transcribed Novem. 1734

the 32d of Euclids 1st book.

I Say that in the triangle ABC, the external angle BCE is equal to the two opposite internal ones ABC, & BAC; for let a circle be drawn, C being the centre. & BC the radius; & let CD be drawn parallel to AB, those two lines being always equidistant, will both have the same inclination to any third line falling upon them; that is (by the definition of angles) they will make equal angles with it: for if any part of CD (for instance) did incline more to BC than AB, upon that very account they would not be paralel; it follows therefore that the angles ABC, & BCD are equal: also BAC = DCE because AE falls on two paralels; but the external angle BCE = BCD + DCE, which was before proved to be equal to ABC & BAC. Q.E.D. Hence may be drawn as Corollaries the 20th 22d & 31st propositions of the third book of Euclid

Revolutiones Planetarum, naturaliter non perpetuò durabunt.

Motum Planetarum circularem vel ellipticum circa Solem, naturaliter non esse perpetuum probandum est. Et, motum hunc circularem duobus motibus compositum esse, quorum alter curvæ revolutionem tangente progredi conatur, & alter ad centrum gravitatis tendit, vobis esse notum nil dubito, et etiam motum ad centrum tendentem eadem ratione semper agere. Cum enim motus projectilis, aliquo modo retardetur, tum motus ad centrum tendens, vel quod idem est, vis centripeta superabit motum vel vim centrifugam; qua vis minuitur, diminuta velocitate progressûs, & ita corpus revolvens ad centrum descendet, & revolutio ejus evit finita. Et ut aliquod medium sit per regiones planetarum diffusum, quod motui illarum obstet, insignis ille Newtonus, rationi valde consentaneum reddit. At si hoc negetur; bene notum, lucem Solis, planetarum, & stellarum fixarum, semper omni loco esse diffusam, cujus resistus tanquam exiguus est, attamen longa duratione motus earum ita certe impediet, ut, motu projectili continuè diminuto, & centripeto eodem manente, Centrifugum centripetus semper superabit, et ita planeta ad Solem centrum gravitatis semper appropinquantes, usque ad Solem ipsum tandem descendent; & ita cessabunt earum revolutiones.

Luna est Habitabilis

Credo, omnem locum haud multum ~~[illegible]~~ hujus terræ quâ vivimus aparatu differentem, habitabilem esse facilé concedetis. Est ut Luna minimè differt proprietatibus hujus terræ Astronomi sibi notum esse affirmunt. plane apparet omnibus quibus inest rationis gradus breviſſimus lunæ faciem esse rotundam, & ut luna super axem revolvit quâ, successione continuâ lucis & umbræ noctis & dici fruitur, et tanquam revolutio ejus non perficitur eodem tempore, revolutio ^ viz 28 vel 29 diebus ^ one hujus terræ attonem non prohibet eam esse habitabilem. et ^ cum idem distet a Sole, qu planetæ omnes calorem accipiant, calor ~~[illegible]~~ apud lunam idem est calore terræ. et etiam astronomi dicunt lunam similem esse terræ compositione, nempe ut ex aqua et tellure vel arena arida vell Solo arido compositam sit, & valde est probabile, lunæ aere esse circumfusam tanquam astronomi adhuc non possunt certè determinare. ~~& si omnia hæc ita sint nemo potest dubitare negare lunam esse habitabilem~~ & cum ~~[illegible]~~ bus his ad vivendum necessariis ~~[illegible]~~ ditetur nemo potest negare lunam esse habitabilem.

and alternations are to be made, or of wc. they are to consist, may be designed.

Lemma I.

If in a right line at any distances be placed any number of things, a b c d, &c. the number of intervals, ab, bc, cd, &c. terminated each by two adjacent things, is one less than the number of things. For whereas every interval is terminated by two adjacent things, if to any number of things be added one thing more, one interval only is thereby added Q.E.D.

Lemma II.

The Number of the Alternations of m things a b c d, &c. different each from other, taken m & m, is m times the Alternations of m−1 things a b c, taken m−1 & m−1. For by Lem. I. the last letter d, besides the position it hath, may have m−2 positions, viz. in the intervals between m−1 things a b c, but it may also have one more, for it may be put first of all, it may therefore have m positions; & those in all the different Orders, whereof m−1 things are capable, wc. being all the possible positions of d, in all the varieties of a b c, is all the variety whereof the whole number of things expos'd are capable. Q. E. D.

Lemma III.

The Number of Alternations of m things a b c d, different each from other, taken m & m, is = to m × m−1 × m−2 × m−3 × m−4 &c. Continued to m places.

For let $m0$, expresse the number of the Alternations of m things different each from other; $\overline{m-1}0$, of $m-1$ things & the like.

'Tis evident, that if $m=1$, it will be $m0 = m$; for there can be but one order of one thing.

And if m be greater than unity, then it will be (by Lem. 2.) $m0 = m \times \overline{m-1}0 = m \times \overline{m-1} \times \overline{m-2}0 = m \times \overline{m-1} \times \overline{m-2} \times \overline{m-3}0$ &c. till we have an equation consisting of m places: i.e. $= m \times \overline{m-1} \times \overline{m-2} \times \overline{m-3}$ &c. continued to m places. 2. E.D.

Lemma IV.

If $m\omega$ expresse the number of Alternations of m things, ap, bp, cp, dp, eq, fr, &c. taken m & m; and α = the number of ps: β = the number of qs: γ = the number of rs: it will be,

$$m\omega = \frac{m \times \overline{m-1} \times \overline{m-2} \times \overline{m-3} \times \overline{m-4} \times \overline{m-5} \text{ \&c. to } m \text{ places}}{p \times \overline{p-1} \times \overline{p-2} \text{ \&c. } \alpha \times q \times \overline{q-1} \times \overline{q-2} \text{ \&c. } \beta \times r \times \overline{r-1} \times \overline{r-2} \text{ \&c. each Series continued to } p, q, r, \text{ \& places respectively.}}$$

For the number of alternations of any number of things, however divided into parts, is produced by a continual multiplication of the alternations of those things among themselves respectively, viz. compose each part, into the number of their Alternations

me

one amongst the other, i.e. in the pre=
=sent case (the Severall occurrences
being Supposed to compose the Several
parts, & consequently the number of
the Alternations of the things compo=
=sing each part equall to unity) mω = to
the number of Alternations of the things
composing the parts one amongst the
other is the Same in this case, as if
the things exposed, being all different,
were divided into the Same parts; for
the things nvc. compose each part in
both cases, are different from the rest
of the things exposed; i.e. by Lemma 3.

$$m\omega = \frac{m\times m-1\times m-2\times m-3\times m-4\times m-5\times m-6\times m-7\times}{P\times p-1\times p-2\times \&c.\,]\,\alpha\times q\times q-1\times q-2\times \&c.\,]\,B\times r\times r-1\times}$$

$$\frac{m-8\times m-9\ \&c.\ \text{continued to } m \text{ places.}}{r-2\times \&c.\,]\ \text{each Series continued to } p,q,r, \text{ places}}$$

respectively. Q. E. D.

Lemma. V.

The number of the Combinations of m thin=
=gs a, b, c, d, &c. different each from other,
taken n & n, is equal to

$$\frac{m\times m-1\times m-2\times m-3\times \&c.}{n\times n-1\times n-2\times n-3\times \&c.}$$ each Series con=
tinued to n places.

For if the things exposed are divided in two
parts viz. in the ratio of n & m−n, tis
evident that their different combinations
taken n & n, are produced by the

Alter

Alternations of the composing parts one amongst the other: and therefore the number of those = to the number of these = to the number of the Alternations of m things taken m & m, the indices of whose occurrences are n & m − n = $\frac{m \times m-1 \times m-2 \times}{n \times n-1 \times \&c. \times}$

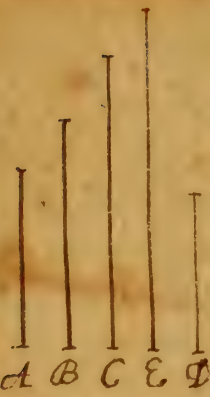
$\frac{m-3 \times m-4 \times \&c.}{-n \times m-n-1 \times \&c.}$ continued to m places. each Series continued to n & m − n places respectively, (by Lem. 4th.) i.e. because n + m − n = m which is equal to $\frac{m \times m-1 \times m-2 \times m-3 \times \&c.}{n \times n-1 \times n-2 \times n-3 \times \&c.}$ &th Series continued to n places by Lem. 3d. therefore

Lemma VI.

The number of the Alternations of m things a, b, c, d, different each from other taken n & n, is = m × m − 1 × m − 2 × m − 3 × &c. continued to n places. Q. E. D.

What's the cube root of 64507824239

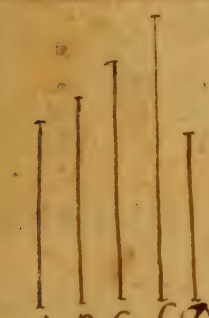
64̇5̇0̇7̇8̇2̇4̇2̇3̇9̇ (4000 Root, less than just.
nearest cube = 64
4000×3 = 12000) 3507824239 (292318,68
first root 4
+0) 2923̇1̇8̇,6̇8̇ (4071
40) 2923
+7 2849
407) 7418
+1 4071
4071) 334768
+8 325744 &c.
Root = 4071,8



The most usefull propositions of the fifth book, are clearly demonstrated by one definition; & that is of Similar or like parts; which are said to be such as are after the same manner, or equally contain'd in their wholes: thus the antecedents A & C, are either equal to their consequents, or greater, or less; if equal the thing is manifest; if less; then (by the definition of proportionals) A and C are like parts of B and E; therefore what proportions the wholes, B & E, have to one another, the same will A & C, have; which is permutation: likewise E:C::B:A, which is inversion. So also if from proportionals you take like parts, the remainders will be proportional; whence Conversion & division are demonstrated: and if to proportionals you add like parts, the wholes will be proportional; which is composition, &c. if the antecedents be greater than the consequents, the consequents will be like parts of them; & the demonstration exactly the same with the former.

The first of the Sixth Book is demonstrated, by conficering the generations of the paralelograms, which are produced by drawing or multiplying the perpendicular upon the basis, that is, takeing it as often as there be parts & divisions in the base: therefore the same proportion that RX Single, hath to NX Single, the same hath RX multiplied by XZ, that is, repeated a certain number of times, to NX multiplied by XZ, that is, repeated the same number of times; which is as much as to say, RX : NX :: parallelogram RZ : paral. NZ. Now that this propofition is true alfo in oblique angled parallelograms, is proved because the are equal to the right angled ones, upon the same basis, & between the same parallels, as does thus independently appear; the triangles R2X, and M2Z, are equal; for RX=MZ 2X=PZ, RM=2P; therefore adding to both M2, R2=MP: if therefore from those equal triangles you take what is common, viz. M2, the remainders will be equal, RXL M=2LZP, to both which add XLZ, and the whole paralelograms will be equal, RZ=2Z. Q. E. D.

That triangles also having a Common base are in proportion of their altitudes does hence follow; because they are the halves of parallelograms on the same basis. This also is true, & the demonstration exactly the same in Prisms, Pyramids, Cylinders, & Cones, having the same bases.



To preve the 16th of the 6th,

I Suppose the 4 lines A, B, C, E, to be proportional, that is, granting A & C to be the lesser terms the same way that A is contained in B, so is C in E; and that D is the denominator of the ratio; twill follow then, that B is made up of A, multiplied by D, and E of C multiplied by D; so that, AD=B and CD=E; draw therefore the extreams upon one another, that is, A upon CD, & the means, that is C upon AD; the factors being being the same, I say the products ACD and CAD, are the same, and consequently equal. Q.E.D.

Reductio Radicalium ad minimos terminos.

Radicalis, ubi totius radix extrahi nequit, plerumque concinnatur extrahendo radicem divisoris alicujus. Sic $\sqrt{aabc}$ extrahendo radicem divisoris aa, fit $a\sqrt{bc}$. et $\sqrt{48}$ extrahendo radicem divisoris 16 fit $4\sqrt{3}$. Et $\sqrt{48aabc}$ extrahendo radicem divisoris 16aa fit $4a\sqrt{3bc}$ Et $\sqrt{\frac{a^3b-4aabb+4ab^3}{cc}}$, extrahendo radicem divisoris $\frac{aa-4ab+4bb}{cc}$, fit $\frac{a-2b}{c}\sqrt{ab}$.

Hac reductio non tantùm concinnandis radicalibus inservit, Sed et earum additioni et Subductioni, si modò ex parte radicali conveniant ubi ad formam simplissimam reducuntur. Tunc enim uniri possunt, quod aliter non fit. Sic $\sqrt{48}+\sqrt{15}$ per reductionem evadit $4\sqrt{3}+5\sqrt{3}$ hoc est $9\sqrt{3}$.

Reductio Radicalium ad eandem denominationem.

Cum in radicalibus diversæ denominationis instituenda est multiplicatio vel divisio, oportet omnes ad eandem denominationem reducere, idque præfigendo signum radicale cujus index est minimus numerus quem earum indices dividunt absque residuo, et Suffixas quantitates toties sumpta una vice in Seducendo quoties index ille jam major evasit

To find the Logarithm of 2000. I look in the first class of my table (wch contains 8) for ye next less to 2, wch is 1,995262315, and against it is 3, wch is the 1st figure of the Logar. Sought. Again dividing the number proposed 2, by 1,995262315 the quotient is 1,002374467, wch being look'd for in the 2d class of the table, & finding neither its equal nor a less, I add 0, to the part of ye Log. found, & look for the said quotient 1,002374467, in the third class, where ye next less is 1,002305238, & against it is 1, to be added to the part of the Log. already found, & dividing the quotient 1,002374467 by 1,002305238 last found in the table, ye quotient is 1,000069010, wch being Sought in the fourth class gives 0, but Sought in ye fifth class gives 2 to be added to the part of the Log. already found: & dividing the last quotient by the number last found in the table, viz. 1,000046053, the quotient is 1,000023015, wch. Sought in the 6th class gives 9, to the part of ye Log. allready found: & dividing the last quotient by the new divisor, viz. 1,000002072, the quotient is 1,000000219, wch. being greater than 1,000000115 Shews that the Log. already found is too little by more than half an unite, wherefore adding 1, you have Brigs's Log. of 2000, viz. 3.3010300.

any Log. be given, Suppose 3,3010300
throw away the characteristick, then over
against these figures 3....0..1.0.3...0...0
you have in their respective classes
1,995262315....0....1,002305238.....0.....
1,000069080....0.....0 &c. multiplied
continually into one another, the product
is 2.000000019966 &c. because the Cha-
=racteristick is 3 becomes 2000,000019966
that is 2000 the natural number desired.

These classes of numbers are no other
than Scales of many mean proportionals: in the
first class between one & ten, so that ye
last number thereof, viz. 1,258925412 is
the tenth root of 10, & the rest in order
ascending are the powers thereof. So in
the 2d class the last number 1,023292992
is the hundredth root of 10. & so each
number in the preceeding class is the
10th power of the corresponding number
in the following class: To construct
these tables requires no more than one
extraction of the fifth or Surfolit root
for each class, the rest being done by
the common rules of arithmetick.

John Osborn's 1744

December 2 1744.

Novimus hoc argenti vivi Corpus ab ide gradu 40 infra 0, ad gradum 600 quo incipit ebullire, contractum fuisse per partes 640 totius molis 10732. adeoque illius proprium pondus fere $\frac{1}{17}$ gravius vel levius, fieri posse a solo calore & frigore nobis hactenus noto. pag. 148. Tom. I.

—— Semina animalium masculina ovis infusata famellarum egent adeo quidem temperato ignis tepore, ut in gradu centesimo Thermoscopii Fahrenheitiani pereant. exusta, in gradu Septuagesimo vix unquam ad frugem perducantur.

Extracta ex Chemia Boerhaviana

Tom. I. Pag. 48
De Salibus

Sal fossile, Gemma, Fontanum, Maris } Hæ tres, ab ortu diversa, Salis Species, ejusdem naturæ; eadem aquæ copia Solvuntur, &c. in $3\frac{1}{4}$; in aere deliquescunt nostro Sua Sponte; crystallos formant fere similes, cubicas, parallelopipedoas, vel pyramidales, lentiore, vel celeriore coacta; affusa ac aquam fortem aurum Solvunt; vi ignis distillant in Spiritus acidos ejusdem naturæ; Soluta in aere humido multum terræ deponunt & liquorem pinguem, acrem, austerum relinquunt; crepitant in igne; fluunt igne magno; diu in illo fixi manent, si puri funduntur; nec tum mutantur; nec Spiritus fundunt & parum modo aqua; alcali non dant; nec putrescendo mutantur.

Nitrum } Nitrum hodiernum, vel Sal petræ crystallos prismaticas formans octohedras; semifossile, ex terra petitum nitrosa, acri, in igne mediocri fusile; vix aquam exhalat; satis fixum; cum omni materie inflammabili, ubi fusum, deflagrans; Solvitur in aqua $6\frac{1}{3}$.

Hæc nitrosa terra, aut Saxi nitrosi, indoles ortum debet excrementis animalium, horum putrefactis cadaveribus, præcipuè Sale marino non utentium, avium ergo imprimis accedente vegetantium exustorum cinere non eluto, & calce viva; denique parati sic nitri, plurima aqua eluti, per arenam transcolatione, atque in crystallos octohedras formatu.

Boerh.

Borax } Tertius Borax, vel Chrysocolla appellatur; fossilis; figura vasa magnam aquæ, vigecuplo majorem copiam ad Solutionem requirens, & ater magnum; Sapore subamarescente Sed dulcescente in exitu; ad ignem facile fluens Simul in Spumas tam assurgentes se effundens aquam plurimam ita dimittens; relicto in vitri pulchri Speciem subsidente; corporum sibi commistorum fluxum in igne valde promovens; Sic metallorum auri præ primis, confabricationem efficiens.

Sal Ammoniacus } Arenarius deinde, vel fossilis; & Ammoniacus, Sal; æstantis Libiæ sitientissimis locis genitus; Cyrenaicus Veterum, circa Ammonis templum copiosiss; ex notis bonitatis Plinio indicatis nostro hodierno Similimus apparet. Sal et circa ignivomos montes eructatur variis terræ locis. Vesevi Sane optimus confectus vel hodie.

Ad fossilia ergo hic referendus erit: licet Ægypto delatus hoc avo animalis creatur. Nonne ex fuligine originem Salam ubique ducit?

Sal fossilis, acidus. Quintus inter fossiles Simplex Sales est acidus, vaporosus, liquidus, forte ubique in fodinis obvius: hic cum oleo fossili, petroleo, oleo terræ, vel bituminibus, unitus Sulphura forte varia nativa, fossilia, pellucida, viva dicta, ut et Semimetallis unita in cinnabari, & antimonio aliisque fossilibus, creat; tam fluida quam consistentia; cum metallis diversa Chalcantha, cum terris calcariis diversa alumina

alumina, componit; ex Pyrita, chal=
=canthi matrice, per ignem vegetantem
=ustulata, Sulphur vulgare producit. —

Alumen } Alumen, verum, fossile,
ex Saxo profunde
Sub terra Sito; aeri, mensis
Spatio exposito, in pulverem fatiscens,
alumini gignendo apta redditur.
alumen requirit decies quater aquae
pondus ut Solvatur: et cryſtallos dat
albas, vel rubellas octoedras.

Vide Tom. I. Page 105.

— — Solus de marino Sale per ignem
extortus liquor acidus, Si aquae diluitur copia
idonia, carnes, pisces, alia facile putrefcentia,
mirifice conservat, corruptionem illorum
prohibet, gratissimo imbuit sapore, digesti=
=oni adaptat quam lenissima, Simulque effectus
aeruantis coli putridos in nutrimenta ipsa,
imo et natos inde morbos pulchre Sanat.
Quare et currentibus per mare in loca alu=
=ena Sub Sole jacentia, quibus putrefacta
Sub fervido climate aqua, putrifacti pisces,
carnes oliga, rancida larda, cedunt in Susten=
=tacula vitae, tantum juvaminis praestat, ut
mirum Sit. Laudem Sane in hac re Summam
meruit Ioannes Rudolphus Glauberus. —

Pag. 155. — — — —

— Aqua pura pluvia a parvo caloris
gradu, sensim magis, magisque calefacta
— dilatatur, ultra $\frac{1}{85}$ extenditur Sua molis:
nam ab gr. caloris 56 usque ad 212. semper ad=
=scendit, quo gradu ebullit, stat, — — —

Tom. I. Pag. 155.
Argentum vivum caloris admotu rarefcit facile.

Thermometrum hoc elegantiffimum, quod ex votis meis mihi perfecit ingenio=fiffimus in Mechanicis Artifex Daniel Gabriel Fahrenheit; id evidentiffime docet. Enimvero hujus Thermometri Cylindrus inferior capit partes Mercurii 11124 in Se, tumque in maximo frigore in Yflandia obfervato attingebant illa extentione Sua notam cui 0 adfcribitur, & unde adfcendens calor Surfum per gradus fupputatur. Quando illud immergo aquæ in hoc vafe contentæ, Senfim=que magis calefactæ magifque, videtis aflidue adfcendens Argentum vivum, donec aqua ebulli=que facta, ut cernitis, ftat, immobilis ad eandem notam; attingitque jam Numerum 212 & pau=lulum plus. Sepofita ergo vitri interea di=latatione, Spatiola jam 11336 occupat quo=rum Summo in frigore replebat modo 11124. unde ad illam caloris differentiam dilatatio molis ejufdem increvit ad $\frac{1}{52-25}$.
$\overline{53}$

— — — —

Pag. 196. — — — Speculum Vi=
=lettianum, ex metallica materie, forma
Spharica cava, cujus apertura diameter
sit quadraginta trium pollicum. Adeoque
area hujus plani, qua admittuntur radii
1452 11/14 pollicum Gallicorum. Figura
cava, est et Spharica, et convexa. Facies
utrinque, qua fieri potuit, arte politissi=
=ma. Massa vero ipsa corporis Speculi
libras libras pendet quadringentas Galli=
=canas. Focus ejus, est Circulus, diametri
semipollicaris, distans tres, et dimidiatum,
pedes in aere, extra Speculi fundum.
Area apertura, est ad aream foci ut
7396 ad 1.

Tom. I. pag. 149.

— — En vas Vitreum, quod capit partes 1933 hujus alcoholis; exit in Cylindr=um anguſtum, ubique æque latum factum ſumma cura; totus hic Cylindrus tenet 96 tales partes, quales inferior pars con=tinet 1933. eſt quoque Cylindrus hic diviſus in numeros reſpondentes hiſce partibus. Ad primum numerum contr=actum fuit alcohol in ſummo quon=dam frigore, in loco telluris frigidiſſi=mo, anno 1709. atqui, dum illi vaſi applicatur calor ſani hominis, expand=it ſe uſque ad numerum 96 in Cylin=dro, eoque hunc replens, liquor.

Itaque hoc in inſtrumento, liquor dictus, a frigore ſummo naturali obſervato, per calorem vitalem ſani hominis expandit ſe uſque ad vigeſimam partem ſuæ molis. interim tamen omnino ad=vertere oportet, poni in hac obſerva=tione, ac ſi capacitas interior hujus [illegible] Thermoſcopii manſiſſe eadem, quum ſane hæc ipſa interea quoq; dilatata fuerit.

Tom. I. pag. 290.

— — & miramur, tale Alcohol, omni dote idem, produci ex omni vegetabili no=bis noto, ſi modo illud aptum naturæ veran=lente deſtillare. Si vero extra vegetantia, atque extra fermentationem abiveris, in=ta ſimile nihil invenis, in quo hæc jam deſcr=natura obtinet. — — —

Tom. I. pag. 291.

- - - Alcohol igni videtur aliquantum Si=
=mile. - - - Utrumque coagulat Sanguinem,
Serum Sanguinis, bilem, carnes, nervos, viscera
albumina ovorum, panem injectum quasi tor=
=ret. An est magnes ignis? Lucem certe in
Se trahit appropinquantem. An Alcohol
igni commissum cum eo effervescit, & ita
ebulliens flammam facit?

Tom. I. pag. 322.

- - - - humores animalium, maxime prius
putrefacti, ignis vi orbati omni volatili parte,
qua Salem volatilem, aut oleum refert, relin=
=quunt carbonis Speciem; quo deinde mista cum
triplo arena, aut carbonum ligneorum pol=
=line triplo, aut cum duplo carbonum & dimidio
aluminis; si tum ex retorta de terra crucibu=
=lorum confecta, lutata, urgetur igne aperto
reverberii, Sensim aucto, Summo, diu aequabili=
=ter continuato; retorta sic accommodata fur=
=no, ut colli ejus os aquam tangat in recipien=
=te contentam vitro agglutinato; ultimo ig=
=ne, post fumos, dat materiem ponderosam,
cineream, granulatim in fundum aquae ca=
=dentem, in aqua non Solubilem, liquescentem
igne, sic fundendam in massulas ad ignem
Sub aqua. Haec Phosphorus Crafftii Kunche=
=lii, Boylei, dicta, si vase clauso, Sub aqua,
in frigore, conservatur, diu incolumis Ser=
=vari potest.

——— Sumitur pars animalis mollis, minutissime concisa, aut aliquis ejus humor vel & excrementa; in Sartagine ferrea, igne modico, agitantur tamdiu Spatula ferrea, donec in pulverem siccum nigrum, ita terendo, versa sit. Aut Sumite aliquod tenue vegitabile, farinam quamcunque verbigratia. Nec enim multum refert, quodnam ex his elegeritis. Sumatur tum una pars talis nigri, ustulati pulveris, eique commisce conterendo Aluminis crudi partes quatuor, fiat pulvis subtilissimus, quem impositum Sartagini ferreæ Supposito igne ustulare oportet, Semper Spatula fere ignita, movendo, conterendo, agitando in forma pulveris terendo; quoties ab igne fusum alumen in massam coit cum pulvere Statim iterum ~~terendo~~ triturando, Semper agitando quam accuratissime, donec tandem nullos amplius fumos ad ignem Suppositum exhalet, Sit tota massa in pulverem tenuem, siccum fixum conversa Sit, prorsusque nigrum. Hunc dein pulverem nigrum, siccumque immitte in phialam puram, siccam, vitream, colli angustioris, eoque illo replendam, donec ampulla tertia pars Superior vacua sit hoc pulvere. Orificium colli hujus phialæ claudatur chartaceo laxe operculo, ut aer libere per illud ingredi, egredi, perpetuo queat; utque vapores interim libere ex collo phiala possint exire. Ponatur dein hæc phiala intra tigillum, vel crucibulum, ita accommodata, ut nusquam crucibuli fundum, aut latera, contingat, Sed arena sic cingatur, ut hæc inter fundum, & parietes, crucibuli bene intercedat; atque obruatur porro ampulla phialæ sic arena, ut per partem ejusdem pro-

prospici queat intra cavum ejus, quo dein queat videri intus, an materia in ampulla jam ignita sit? Cingatur tum hac crucibulum cum arena & imposita phiala, prunis accen=sis lente & prudenter, donec undique perca=luerit: auge tum ignem, ut crucibulum, are=na, & ~~imposita~~ phiala, materies in illa, can=descant ab igne. Id ubi animadvertitur, sus=tineatur dein in hac violentia ignis spatio hora. Tum, dum vis ignis adhuc perstat, orificium colli phiala superius cera accuratissime clau=de, ut prorsus nihil aeris introire queat. Refrigerentur sponte omnia. Erit in phia=la carbo niger, pulverulentus, ex pulvere, & alumine. Si de hac materie, sic praparata, aliquid ex vase excutitur in aera frigidum, ipso illo momento ignem concipit, ardetque. Sed si attigerit semel aerem, amittit hanc vim ignescendi in aere. Atque hanc vim conservat integro trium mensium spatio, si modo cautissime prohibetur omne cum aere externo commercium.

Tom. I. pag. 326.

— — — — Olei vitrioli unciae tres in phi=ala vitrea, cujus collum abscissum, misceantur cum aquae unciis duodecim, dein retineatur ha phiala, quae mediocris esto capacitatis, in calore modico, injiciatur tum diversis vicibus limati ferri semiuncia, aut uncia, exoriatur vapor albus, qui, hidore sulphurato allis de collo phiala eructans, ab admota candela fulminis instar accenditur vehementis, cum=que ingenti impetu intra phialam ripitur, ibique violente repercussa, mixta sane pro=tat: ita quidem, ut videatur, materies, tale halitus, formans, qui surgenti in vapores ab igne suppositi actos alcoholi assimilantur penitus

T. I. pag. 327

— — — Si ad drachmam in vase vitreo ponitur oleum Stillatitium Cariophyllorum orientalium, ligni Saffafras, Terebinthina, carui, atque dein deflegler infunditur aqualis, aut Sesquialtera pars Spiritus nitri Glau=beriani, oritur violenta, de frigidis ante comistionem, flamma

Tom. I. pag 369.

— — — Tandem quoque detectum fuit, quod Aer communis, circa telluvem nostr=am, tempore ponderis medii in Atmos=phara, simulque in calore anni totius medio, si comparatur cum aqua ratione ponderis, sit fere Octingenties, & quinquagesies le=vior aqua.

Tom. I. pag. 387.

— — — Atmosphara ad Thermometrum Fahrenheitianum calida 46 gradus, si in=de incaluscit ultra per 166 gradus, jam calorem obtinet 212 graduum, quo calore aqua ebullit. Tum vero factus est hic aer rarior una tertia sua molis, ex Amon=tonsianis. calor igitur 166 graduum ex=pandit aerva ad unam tertiam. Si dein gradus frigoris quadraginta adduntur ad 212, habebuntur gradus 252 pro distantia inter frigus summum cognitum, & inter calorem ebullientis aqua; intra quam distantiam aer condensatur at $\frac{42}{83}$, sive circiter at $\frac{1}{2}$ totius. Eodem calculo, si posuerimus summum calorem naturalem Atmosphara ad gradus 90, quod raro observatum, tam, a summo frigore naturali ad astum aroden=tissimum naturalem, steris raritatem aut

aut denſitatem creſcere, aut minui poſſe ad $\frac{15}{85}$ ſive $\frac{1}{5}$ circiter.

Tom. I. pag. 393.

– – – – Aqua eſt forte 850 vicibus pon=derioſior aere communi; & ſi ita ſit, tum octingenteſima quinquageſima pars aeris communis foret aqua, tum ſane totam pondus aeris deberetur uni aquae, quae in aere volitat.

Tom. I. pag. 394.

– – – Uncia enim Salis Tartari, mutata in quatuor fere uncias olei tartari per deli=quium, attraxit tres uncias aquae. – – – – – – – pag. 395. – – Oleum tartari per deliquium pondere ſe habet ad aquam ut 7 ad 5, ad aerem vero ut 1190 ad 1. – – – in illo oleo tartari per deliquium, ſic nato, nihil Elaſtici aerii ineſſe depre=hendatur.

Tom. I. pag. 450.

– – – vidi magno meo bono perlegi, et laudavi, elaboratiſſimum tractatum, quem ante biennium edidit Vir clariſſimus, Ste=phanus Hales, cuique titulum ſcripſit Staticen Vegetabilium: in ejus enim capite ſex=o, labore ſumme, ſed ſapienter directo, capta experimenta ordine propoſuit quam maxime concinno, remque abſolvit. Eo ergo vos ab=lego; ut naturam arte detectam coram contemplemini.

Tom. I. pag. 452.

— — — — nusquam id apparet manifestius, quam in machina Papiniana. Intra Cylindrum aeneum offa anagli bovis, aqua, et aer, ita concludantur simul, ut nihil penitus aeris, aut aquae, expirare de hoc vase, ullo modo, possit. Tum applicatur ignis, ut aqua ebulliat. Aer ergo acquirit potestatem se expandendi proportionalem calori dato: sic et aqua. Unde intelligitur aeris hic et aquae ab offa quam fortissima appressio. Interim simul aer et aqua intra vas, inter se, et super offa, incredibili jam velocitate moventur, et hinc intra pauca minuta horae offa illa convertant emolliendo in liquorem viscosum, aut in massam teneram, mollem, scissilem quam facillime.

Tom. I. pag. 483.

— — — Dum aer erat in temperie Graduum triginta octo, sumpti salis marini, purissimi, siccissimi, in pollinem subtilem reducti, binas uncias, quae patiebatur se dissolvi, in Aqua Stillatitia, pura, pluvia, unciis sex & drachmis tribus. — — — Salis Gemmae sic paratae uncia una postulabat, ut solveretur, Aqua ejusdem uncias 3 & drachmas duas russus, ut 4 ad 13.. Sal Ammoniacus, purissimus, siccissimus, in pulverem redactus, ad unciam solvendam indigebat Aquae talis unciis 3 & drach. 2. Nitri puri, sicci, in pollinem contriti drachma novem, in Aqua stillatitia illius, unciis sex solvebantur. Unde tres nitri in novemdecim partibus Aquae.

Boyle.

Boracis Siccissimi Semiuncia ultra Decem uncias Aqua exigit, ut Solvatur integre: unde ut 1 ad 20. Aluminis uncia in Aqua Stillatitia unciis 14. Salis Ebsonienſis uncia Solvitur in Aqua uncia & Drachmis duabus. Salis Tartari uncia in Sesquiuncia Aqua ejusdem dissolvitur. Uncia tres Aqua, si diu agitantur valide cum Arcani duplicati Cucis Holsatia Semiuncia, hanc penitus dissolvunt. Uncia tres Aqua diu conquassata Solverunt Drachmam & dimidiam vitrioli communis viridis.

Tom. I. pag. 560.

— — — Sex metalla Solida, aurum, plumbum, argentum, as, ferrum Stannum. Quae quidem ubi frigent, dura, Solida, in Se invicem nihil agunt, postquam vero fusa Sunt in igne, tum Misceri intime inter Se possunt, ut fiat ad Sensum massa homogenia, qua hoc miri habet, quod in unaquaque particula massa confusa eadem Semper inveniatur proportio diversi metalli, qua in tota mola.

— — — — — — ad pag. 561.

— — — Semimetalla Solida, quo referre licet Stibium, Cinnabarim, Bismuthum, marchasitam, Zincum. Quae etiam, instar metallorum, igne fusa, misceri, atque Se invicem dividere possunt, quis definiet quousque? quin et eadem pariter inſis metallis quoque conjundi, intermisceri, simili effecta possunt. Cinnabaris quidem difficilius, facilius cetera.

Semper

Semper autem metallis admisto illo omnem demunt malleabilitatem, fragilitatem vero conciliant ita, ut in pollinem tundi se patiantur vel lentissima prius, idque iterum contingat in quacunque vel minima particula metallorum. — — —

— — — pag. 562. — — Enimvero Stanni libra ad ignem liquefacti, confunde veguli Stibii scrupulum, massa frigefacta, homogenia apparens, erit in omni parte sua adeo fragilis, ut, si minimam ejusdem particulam acceperis, nunquam reperturus sis in illa malleabilitatem naturalem Stanno; imo contra in unaquaque portiuncula Stanni proportionalis antimonii pars accurate semper permista invenitur.

24

Tom. I. pag. 628.

— — — olea, coctione diuturna, orbata sunt, omnia adhaerescente acido. Hinc dudum observavere aeris & chalibis imprimis politores aeruginem, ferruginemque, splendentium metallorum in aere praecaveri haud posse, si oleo inunguntur crudo, sed quam optime dum cocto inducuntur, imprimis vero, quando simul cerussa pauxillum, vel plumbaginis, simul intexit in illo oleo, quorum acidulum illud penitus imbibitur: unde paratur linamentum optimum servando nitori, atque aciei, talium instrumentorum. — — —

— — — — pag. 630. — — Antimonium in pollinem contritum, aut sublimatum protrusus in flores, si decoquetur in vase cum oleo, dabit brevi ballamum crassum, rubrum Antimonii, qui oritur tantum ex sulphure stibii resoluto in oleo, dum regulina pars sola manet, oleo intacta, orbata sulphure. Eodem modo res se habet in aliis quoque semimetallis, quae sulphure abundant.

Tom. I. pag. 654.

— — — Potestas etiam illa attrahendi Acidum in Alcalibus et limitata prorsus, & definit in certis terminis, unde ingens diversitas in his; quæ tamen magis differentiæ acidorum, quam alcalium varietati debetur. Quam quidem rem, scitu utilissimam præclarus Hombergius, ut alia omnia felicissime expressit in Monumentis Ac. R. Sc. T. I. p. 52. Unde pauca huc transferre fas esto.

Uncia igitur Salis Tartari absorbuit in se acidum omne ex unciis quatuordecim Aceti Stillatitii optimi. indeque post exsiccationem, aucta fuit ponderе drachmarum trium, & granorum triginta Sex. Reliqua partes illius Aceti fuere mera aqua ~~aspera~~ insipida. — — — —

Ex Spiritu Salis absorpsit uncias duas et drachmas quinque, ponderosior inde dracmas tres & grana quatuordecim.

Ex Spiritu Nitri unciam unam, drachmas duas, grana triginta Sex. facto pondere exin ad drachmas tres & grana decem.

De aqua forti assumsit unciam, binas drachmas, grana triginta. Augmentum ponderis drachmæ tres, grana Sex.

De Oleo Vitrioli drachmas quinque. Auctio ponderis drachmarum trium, granorum quinque.

Tom. I. pag. 657.

— — — Si Alcali accurate Saturato per acetum, aut tartaro regenerato, affusus fuerit Spiritus Nitri, aut Salis, vel Sulphuris, aut vitrioli, tum statim latens Alcali attrahit in se illud acidum, atque repellit a se acidum aceti, quo prius Saturatum fuerat; unde postea de hoc composito, Spiritus fere aceti igne Satis leni evocari facile poterit, manente Sale nitroso regenerato ad fundum vasis, Salis fixo. — — — et generaliter Acida fortiora, ex fede alcalina, expellere debiliora.

Tom. I. pag. 665.

— — Requiritur interim, ut adhuc verbo moneamus, alcalia in Argentum vivum Sincerum, [redacted] nihil agere virtute menstrui, quomodocunque enim hæc bina componuntur, nulla mutatio accidere mercurio puro deprehenditur. — — — —

— — — Aurum et Argentum, quantum ejus Scio, non mutantur ab alcali. In cæteris quidem metallis agere plus deprehenditur Alcali: forte quia adjunctam habeat Mercuriale Sua parti aliam, quæ ad naturam pinguis, aut Sulphuris cujusdam, naturam magis accedens, obnoxia est virtuti Salis alcalini. Quum vero hæc externa Sulphura, non patiantur Se adeo facile avelli a gleba illa metallica, cum qua concreverant, hinc Sepe fit, ut alcalini Sales, dum agunt in hæc Sulphura, Simul et metallicam mercurialem partem, Sulphuri arcte adjunctam, mutare videantur; quamvis interim ipsum Mercurium in Sua natura non attingant. Hoc evidentissime Sum expertus, dum Stibium vulgare fudi cum Sale Tartari; tota enim massa, tam Sulphurea, quam mercurialis, Antimonii Solvebatur in unam massam fuscam, nullo Subsidente Regulo. Quando autem Regulum Stibii, unde Sulphur externum prius Separatum fuit, fundo cum alcali fixo, tam alcali Supernatans in fluore, Sulphurei adhuc quid elicit, unde color aureus conciliatur alcalino Sale; pars autem Regulina, mercurialis Antimonii, purior, atque argenteo colore præstantior, in fundo decurrit

Tom. I. pag. 676

— — — (Oleum vel acidum Vitrioli) Septimo ferrum prompte Solvit, Cuprum lentius utcunque, argentum valde difficile, Argentum vivum non nisi in gradibus 360 caloris; plumbum non Solvit, nec Stannum. In Ceteris hoc acidum reliquis acidis convenit. Quibusdam id habet commune, quod camphoram perfecte Solvat in oleum liquidum; quod copiosa aqua adjecta iterum in camphoram veram redit.

Acidum Nitri, hoc proprium habet, quod ubi fervet acta ignis, semper ruberrimos fumos creet, Solvat Argentum in cristallos amariffimas, causticas, qua Solutio huic Spiritui propria; quum vix alio acido queat perfici; Oleum enim purum vitrioli difficulter eam praestat. Solvit etiam Mercurium Saturnum venerem. Aurum vero non attingit, Stannum vix dissolvit. Acidum hoc ubi semel metallis suis Solutis se penitus immiscuit, fortiter satis iisdem adhaeret, sic quidem, ut in igne satis magno remaneat in metallo, id patet in argento sic soluto, quod patitur se fundi in lapidem infernalem, retento rodente Spiritu. Mercurius praecipitatus ruber quoque, quando vita fixatus est, quamdiu resistit igni, quam intense, priusquam deserat suum acidum adhaerescens?

Acidum Salis Marini, habet hoc proprium, quod si de Sale purissimo Spiritus fuerit factus, inque novo Sale purissimo iterum destillatus, semper, ubi violentia ignis affuat, fumos albos det, aurumque solvat, quod nullo alio acido in rerum natura (cognito) penetrare potest. Solvit et Stannum, quin & Mercurium cum flatulento sonitu, Ferrum, as, sed argentum nullo modo solvit. Neque et plumbum dissolvit penitus. Hinc igitur acidum constituit iterum, suo in genere prorsus singulare. (32)

Unde igitur sincerus Spiritus Nitri & Spiritus Salis, sunt duo diversissima liquida, & tamen mirifice propinqua sibi invicem, & stupenda facilitate mutabilia. Quod in Historia mysteriorum omnino debet considerari, res autem ipsa se sic habet.

Si Spiritus Nitri, in retorta vitrea cohobatur, supra nitrum siccissimum, sed arte summa depuratum, at nihil prorsus Salis marini illi nitro insit, tum fit Spiritus ille Nitri optimus, singulaque cohobatione melior, ad omnia propria operа Spiritus nitri. Si autem illa cohobatio fit supra nitrum vulgare, non reddetum purius per crystallisationem, tum Spiritus nitri ita cohobatus, amittet naturam Spiritus nitri, non solvet argentum amplius; acquiret vero indolem Spiritus Salis

Tom. I. pag. 678.

Spiritus Salis marini, vel aqua regia, solvetque aurum. Si autem hoc observatum adeo paradoxon, rite excutitur, facile videmus in illo naturale nitro adhuc aliquid Salis marini adhaerere, quod ipsum in tali opera simul in destillatione se immiscet. Hinc ex Spiritu nitri aquam regiam format. quod sequenti ruffum experimento patet. Accipiatur Salis marini pars una, pura, sicca, decrepitata, in pollinem trita, immittatur retorta purissima, huic superfunde Spiritus nitri, vel aqua docimastica bona partes quatuor. Fiat destillatio lege artis, ad summam siccitatem usque, igne arena forti ad finem. Spiritus acidus, ita productus, erit aqua regia, non amplius aqua fortis, solvet aurum, non attinget argentum. Si dein Salem examinaverus, qui in fundo retorta superest ab hoc labore, illum solvendo, colando, crystallisando, nanciscemur purum, verum, inflammabile Nitrum. Vide Boyl. Op. form. 215.

Rursum, Si sumatur Nitri purissimi pars una, Spiritus Salis marini optimi ad partes duas, fiat destillatio lege artis ex retorta, prodibit Spiritus, qui aurum solvit longe facilius, promtiusque quam Spiritus Salis marini solet facere. Sal autem in fundo remanens, post destillationem summam si iterum solvitur aqua, colatur crystallisatur, fit bonum inflammabile Nitrum. Boyl. ibid. a 215. ad 224. &c. Hinc igitur aqua fortis, fit aqua regia, simulac modo Spiritus nitri & Spiritus Salis, quamodocunque misceantur, & fere quacunque proportione. (66)

Atque hæc quidem, tradita hactenus acidorum historia habetur. In qua quidem illud primo mirabile, quod de non Acidis tam facile gignantur acida: ut in acidis vegetantibus supra constitit. Vinumque optimum non acidum, in lagena pura arctissime obturata, reclusum, dein ala malendina alligatam, intra spatium trium dierum, conversum fuit in acetum bonum, juxta observationem Hombergii, Ac. R. Sc. T. II. pag. II. Dein & illud valde mirum, quod tamen acida semel genita, atque diutissime ignem experta, vix mutentur; nam aqua fortis, aqua regia, Spiritus Nitri, Spiritus Salis, oleum vitrioli, per quatuor annos, vasis hermetice sigillatis, in calore æquabili athanoris digesta, vim solvendi retinebant eandem. Solum Acetum evaserat insipidum, odore aromaticum. Et Spiritus Salis inceperat vitrum suum rodere.

— — — — — —

— — Quis usquam in rerum universo, Spiritum nitri reperit, nisi de existente prius nitro. Atqui Nitrum, de terra excrementis animalium facta, calce & alcali, & aere, nascitur; aut ex Spiritu Nitri prius puro, in alcali sincerum attracto, imprimis in fixum. Aut et pingues valde, fertilesque terræ, a pluvia prohibita, & impedita penitus, ne alendo vegetabilia nutrimenta sua consumant, diuturnitate temporis

omnes

omnes impregnarentur nitro facundo, si modo omnis salis marini accessus inde prohibetur. Vide Boyl. Chem. Sc. 177. atque inde liquet Spiritum acidum Nitri solo igni nasci ex mutato Nitro puro; ipsum autem nativum Nitrum produci sine hoc Spirita prius nato. Quarto igitur, acida haec, dum corpora solvunt, cum iis concrescere, mutari, in nova verti, & sic plurima nasci diversa ex uno. Etenim Spiritus Nitri solvit argentum, plumbum, stannum mire mutat, cuprum, Mercurium Nitrum, & Antimonium zinctum, Emeriam, et cum singulis semper creat alia corpora, odore, sapore, colore densitate, effectibus omnibus. Vid. Boyl. Mech. qual. 118. 119. Quinto; conveniunt omnia haec acida inter se in quibusdam, differunt in aliis.

Pag. 680. Tom. I.

Conveniunt in compositione cum Alcalicis, quoad effervescentias, indeque natas salium novorum origines. Item in compositione cum creta, coralliis, lapide cancrorum, perlis, matre perlarum, testis cochlearum, mytilorum, ostreorum, cornibus, ossibus, unguibus, calce viva calce extincta, ferro, cupro: omnia enim haec solent ocyus tardius, dissolvi per acida quaecunque, sive magno id cum impetu fiat, sive quiete. Soluta haec in se-traxere semper acidum solventis ex aqua illa, in qua id acidum prius diluerat. Dein materies haec ita soluta, unita solventi suo acido sali, convertitur in naturam salini, potestque dilui in aqua ac si sal esset, quamdiu acidum illud ei ad haeret

adhaeret; quamvis antea corpora haec omnia nullo modo in aqua potuerant dissolvi. Quando autem Acidum illud Solvens iterum abducitur de materie sua Soluta tam Solet Semper illa iterum apparere instar terrae, qua in aqua Solvi renuit quam maxime. Unde igitur liquet, quanta sepe fallacia aqua nobis apparens credulis imponat; dum Specie decepti putant meram aquam elementalem fuisse, qua certis operibus adhibeatur, dum interim in hac aqua latuerint dissoluta corpora, & Solventia simul. — — — —

— — Dentis metallis, acida in genere, accurate, & ad Saturantem mensuram unita corporibus modo recensitis, amittant omnem acrimoniam, plerumque omnem saporem sicque lateant penitus. Solvat Nitri Spiritus Drachmas quatuor, et grana novem, lapidis cancrorum, ut Solet facere: Sit autem Solutio haec facta exquisitissime ad definitum Saturationis punctum, erit liquor limpidus insipidus fere; diluatur ille aqua purissima, coletur dein; atque detineatur in calore moderato aliquamdiu, apparebit aqua pura. Quando autem instillatur Liquido huic, Alcali forte fixum, mox iterum in fundum labitur omnis moles Soluta; quam incautus Sola de aqua natam falso Suspicaretur. — —

— — — — Tom. I. pag. 681.

Differunt autem inter se haec acida quam maxime primo copia Acidi veri, ratione aqua admista.

Uncia	Aceti optimi	continet veri acidi	gr. 18.	relictum totum aqua pura
	Spiritus Salis		ʒj. & gr. 13.	
	Spiritus Nitri		ʒij. & gr. 23.	
	Olei Vitrioli		ʒiv. & gr. 56.	

Secundo ipsum hoc Acidum, jam in qualibet Specie Sincerum, virtute Solvendi differt mirifice: nam Acidum nitri, coctum cum Auro illud vix afficit, nisi quod nigrum reddat, argentum Solvit illico. Aqua Regia conflata; unde patet Acidum ibi non agere ut acidum, Seo ut Singulare corpus. Tertio differunt acida hac & in eo, quod quaedam mutentur longe alia ratione, quasi in novum corpus, dum Suum objectum Solvunt, alia minus. — — — Quarto, idem Acidum in una objecto mutatur valde, in altero, vix vel non.

Tom. I. pag. 688.

Si verum est Glauberianum Dictum, ex Sale marino, Alcali fixo, & Calce viva mistis, igne ustulatis ad ignitionem usq; aeri expositis, inde humectatis, nasci verum Nitrum

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Tom. I. pag. 689.

— — — Si alcalia volatilia jungantur fixis alcalicis, tunc volatilia semper fortiora, duriora, volatiliora redduntur per actionem ignis; fixa autem, dum attrahunt acidula ex alcalicis volatilibus forte reliquas ut & et olea, terrestria vero retinent, hinc evadunt semper alia, composita, & alterius prorsus efficaciae.

Tom. I. pag. 694. 12

--Si enim Alcali purum unitur Sali marino in aqua dissoluto turbatur myria, terra quaedam praecipitatur, Sal dein crystallisando rite paratus, purus, marinus habetur. Lixivio Nitri additum Alcali fixum albitudinem turbulentam conciliat, terram praecipitat, Nitrum deinc omnium depuratissimum profert. Alcali fixum

Tom. I. pag. 694.

Alcali fixum Ammoniaca Myria infusum mox arripit Acidum ejusdem, hinc Alcali liberat, redit profugum, & in fundo gignit purum Salem marinum fixum, explosso in auras Alcalico volatili. Alcali purum volatile affusum Myria marini Salis, turbat, depurat, dein aufugit. Si idem Nitro Soluto misceatur, idem facit nitrumque depurat. Si Ammoniaco Sali fuerit commistus in aqua bene diluto, ibidem quoque depurationem similem producit, Chorum Salem haud turbat in sua natura Ammoniaca, sed intactis inde viribus recedit, cum quibus accesserat. Acida vegetantia mista Sali Marino, Nitro, Ammoniaco, parum ilia mutant. Quin eadem acida vegetantia fermentata, sive et destillata, quidve, pluviova, commista cum Salibus iisdem non multum mutant

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Tom. I. pag. 695.

— — Verum si Argentum vivum conteritur rite cum Vitriolo calcinato, quousque incipit subigi, tumque huic misto Sal marinus decrepitatus additur; si deinde mistum hoc cucurbita committitur vitrea, atque subministratur lente per gradus, igne levi, urgetur, tunc iterum acidum vitrioli vertit acidum Salis marini in Spiritum, qui tum motus, qui tum motus & calefactus, dissolvit mercurium ut solet: moxque Solutum Sublimat, in Mercurium Sublimatum purum: Qui nihil aliud est, quam Spiritus Salis marini purissimus, qui attractus est in mercurium, eique unitus in massam homogeneam, vitriolicam, mercurialem in aqua solubilem

Methodus utendi Salibus Tachenianis.

Primo. Assumendi vacuo, & digestionis munere perfuncto, ventriculo: adeoque Decem ab ultima refectione horis. Utroque prò diversitate usuri exhibere licet a grani=nis quatuor, ad Drachmas binas, aut plures prout Medici præscribentis Sapientia judi=cat.

Secundo. Debent larga aquæ copia dilui: ne primo occursu lædant fauces, Stoma=chum, ventriculum, si nimis moraca po=tantur. Itaque drachma Salis solvatur in unciis novem aquæ communis, puræ;

Tertio. Si Medici consilium alvum ciere ægro; tum Vesperi, antequam lectum adeat, sumat semidrachmam pilularum Rufi. Sequenti mane surgat mature, deambulet in aere frigidiusculo, caveat sudorem, bibat inter ambulandum dosin requisitam divisam in quinque, vel sex, doses. Effectus est quam optimus; purgat, levat, non solvit vires. Sapien=tum ventribus ventribus vera medela, & radicatos alte morbos extirpans, omni alii purgationi rebelles. (experiemini melancholicos, alvi segnitie oppletos, haud feliciori methodo levari, quam vitæ instituto, bene directo, satisque diu con=tinuato horum usu. Qua quidem in re id eximii habetur, quod solutus horum virtute venter suo dein munere fungi nergat, nec offeretur postea, quod pur=gantibus aliis negatur)

Quarto.

Quarto. Si venes potius expurgandi videntur, & sanguifera vasa. Fiant omnia ut prius. Omittatur vesperi aloe. Lumbi & hypogastria, tegantur magis quam reliqua partes corporis. Superbibatur subinde haustulus Theæ, vel coffeæ.

Quinto. Quando sudor exprimendus videtur de corpore: bibantur decumbenti in lecto mane, sub iisdem legibus, sorbeatur post singulos haustus leve sudoriferum, quale decoctum quinque radicum aperientium, ligni santali, vel sassafras, aut Theæ, vel coffeæ. Satisque tecto corpore sudor proliciatur pro ratione morbi.

Sexto. Si febres autumnales, intermittentes, tertianas, quartanasve, hoc remedio sanare satagis, tum duabus, tribusve diebus successivis purga, juxta observationem tertiam. Dein quatuor horis ante exacerbationem venturam excitetur levis sudor secundum observationem quintam, ita, ut ager imprimis sudet fortiter satis, circa illud tempus paroxismi. Sta feliciissime pertinaces febres propelluntur.

Tom. II. pag. 53.

Sal Acerrimus, Alcalinus, igneus, cum calce viva.

Sumitur calx de Saxis exustis parata, recentissima, Siccissima, Solida, nullo attacta humido, neque hactenus fissa; cujus una pars accipitur, & huic Superimponuntur cinerum clavellatorum purissimorum partes duæ ita, ut calx hoc alcali undique bene tecta sit. Hæc Simul relinquuntur sta, in vase, donec calx incipit fissa dehiscere. Tum aquæ puræ calidæ additur quadruplum, & fiat lixivium limpidum transcolando per linteum densum, in manicam Hippocratis formatum, donec transeat liquida instar aquæ limpidum. Hoc lixivium in vase ferreo Supra ignem inspissato, cavendo ne ebulliendo transfundat, donec penitus Siccum sit. Tum adhibe ignem tam fortem ut vas candefiat, Simulac non fumat amplius, fundetur. &c

Aqua Stillatitia vulgaris, per vesicam, herbæ recentis. Tom. II. pag. 60.

— — — Sed ut distincte agamus, colligemus id quod a gradu caloris æstivi naturalis usque ad gradus ~~ebull.~~ 214 avolat de planta recenti. — — — — Herba, huic operi destinata, carpenda Sunt, illo in vigore Suæ ætatis, quo folia illarum jam adulta, caterasque partes Se quam proxime accingunt producendis brevi floribus, et gignendis inde fructibus, Sed prius quam flores perfecerint & Semina: quia effata redditur crebro virtus plantarum

Plantarum, quam in his aquis quærimus, postquam fructus absolverunt; Speciem quip=pe marcescentis languoris dein observatur. Tempus vero Autora imprimis legendis fa=vet: quoniam volatilia tum collecta frigore nocturno, & roris lentore coercita, nondum calore Solis dissipata sunt. Atque hac qui=dem ita intelligimus, quoties qualita hac opere virtus aqua Stillatitia præcipua hæret in foliis, ut in mentha, majorana, pulegio, ruta, et quamplurimis obtinet.

Aliter se res habet, quando in floribus aut Seminibus, aromatica vis, neque in aliis planta partibus deprehenditur. Rosa, lilia, lilia convallium, multa alia, exemplum præbent: tunc enim eligimus partes florales quando odorem suum diffundunt fragrantiſ=simum. Carpere igitur oportet flosculos, fere jam apertos, necdum Marcescentes, matu=tino rore perfusos. Ita quoque aliis in herbis Semina præferenda cæteris, ut in cumino, anisso, caro, aliis plurimis obtinet, quibus herba, flosque inest, tota vero virtus Solo in Semi=ne unice hæret, nobili se fragrantia, & Sapore acri, ibi tantum manifestans. Qua in re experimur, Semina hanc virtutem imprimis ostendere, postquam jam ad ætatem perfectam maturitate plena pervenerunt. Neque fas est præterire quandoque amabiles has soles, Sola radice quarundam plantarum nasci. Cariophyllata doceat, doceat Telephium radice rosam spirante. Tum vero necesse est radices hunc in finem legere — — — matutino tempore, ea anni tempestate, qua mox folia de illa radice pullulabunt. (tum Vitiores plerumque sunt) 52.

Tali vegetabili, contuso, si opus, aut conciso, impletur ahenum destillatorium ad duas tertias capacis alvi, ut suprema tertia vacet, herba autem non intra vas comprimenda; affunditur ea copia pluviæ recentis, quæ sufficit, ut repleat vesicam hanc ad eandem altitudinem, scilicet ad duas tertias cum herbis. Capitellum accurate collo suo margini orificii accommodetur ita, ut nihil vaporis inter commissuras transire queat. — Extremo naso alembici intra os patulum canalis spiralis immisso, fiat ibidem conglutinatio glutine confecto ex farina lixi subacta cum aqua in pastam densissimam. Habeatur cura, ut cavitas serpentis stannei nitida semper sit transiectu aquæ puræ ebullientis: ne aquam transituram inquinet. Applicatur extremo serpentis infimo receptaculum; quo ita nullus vapor destillando exhalet, sed frigefactus in dolio frigido pleno liquor integer colligi queat. Quod imprimis efficitur, si aqua in dolio refrigeratorio adjectu nova semper frigida retineatur.

Leni tum calore graduum 150, viginti quatuor horis, fiat digestio, post hunc apparatum. Tum instruatur focus sub vesica, donec ebulliat leniter modo aqua cum herbis in vesica.

— —

— Gradus igitur ille caloris, sollicite ita observatus, sustineri æqualiter debet, quamdiu aqua in excipulum destillans alba, crassa, sordida, sapida, spumosa, turbida, apparet. Tunc enim accurate debet retineri separata ab alia aqua, quæ post hanc sequetur. Hinc

Hinc excipulum sæpe mutari debet: ut certus sit artifex, solam primam aquam adhuc provenire. Post hanc enim expressam altera subsequitur pellucida tenuis, odore proprio plantæ careas, sed acidulum spirans ut plurimum, sapore nativo plantæ destituta, sed acidula fere, vix spumosa, sed limpidior, nisi quod filamentis albis, flocculentisque quodammodo sordescat ejus limpiditas: quin etiam, si cava alembici anei haud accurate obducta stanno, acabo postremo aqua ære rubo inficitur, unde viri- deficit, nauseosa, emetica, venenata evadit utentibus, debilibus imprimis, infantibusque, sursum deorsum, acri cum tormine, alvum perturbans. Quæ mala si infortunato accidevint, largo lactis mellitis usu levantur, aut liberaliori decotorum emollientium potu.

Tom. II. pag. 64.

Discimus hoc opere primo, quidnam æstu ebullientis aquæ discedat de planta? nempe 1. Aqua primi processus. 2. Oleum volatile plantæ, cum suo inhærente spiritu. 3. Acidum salinum. — — — — — — — — Inde scitur, quid in culina, & pharmacia, coquendo exhalet? quid maneat? Balsamita major, Chærophyllum, Melissa, Paludapium si jure carnium incoquunt, proprium odorem saporem, pendentes inde vires, penitus perdunt, relinquunt communia, nec grata. Si vero secta minutatim, jusi carnium jam parato, fervido adhuc, neque tamen ebullienti, vase bene clauso, immissa macerantur, tum jura hac virtute propria imprænant. — — — Si abstitis statim, ac alba aqua (destillare) definit, bonam habebis, pretiosam, sympham

ympham. Si avarus conaris plus elicere, sicque acidam postremam, priori bonae confundis, perdidisti omnia. Interim moneam terum, aquas Stillatitias plantarum inodorarum, & acri aromatico carentium, tamen efficaces valde facultates possidere posse; licet fere aliter credatur.

Aqua Stillatitia vulgaris per vesicam, repetita cum nova herba (cohobata) Rosmarina.

Processus praecimus docuit, quid aqua & ignis, separet de planta, quid in eadem relinquat? Jam vero hoc in opere docemur modum aperiendi magis plantas, & ita tractandi, ut aquas prebeant Stillatitias, longe ditiores illis Stirpium dotibus, quas in priore artificio laudavimus.

2. Duo quidem propositio herbas, a praecedenti destillatione Superstites in aheno, & liquorem, qui in eodem Superserat, post eductam aquam Stillatitiam, per pannum premimus, quam fortissime, ut omne illud decoctum, sine jactura, habeatur. Huic postea admisceatur omnis aqua Stillatitia quae praecedenti processu fuerat producta. Mistum hoc aheno infunditur, & ei additur tantum de eadem herba recenti, ut in praecedenti erat inditum. Additurque, si opus est, tantum aquae, quantum requiritur, ut liquoris ad herbam proportio sit, quae ibi descripta fuit. Tum vasis ad

3. Tum vasis arctissime clausis totum hoc compositum fovetur, trium nychthemerorum spatio calore 150 graduum — — — Vocatur haec Digestio. Quae tanto tempore continuata, multum prodest; si nimis longo tempore continuatur, mutationem inducit, quae in putrefactionem tendit.

4. Peragitur tum destillatio eadem lege, ut in praecedenti processu; ita tamen ut cautius, paulogue lentius, procedas in initio. — — —

compendium, vix alia ratione imitabile. Nam non multum mutatur plantæ nativa potestas in hoc opere; minus certe, quam quidem aliis modis. Licet bene noverim aliquid mutari tam diuturna applicatione coctionis; attamen nativam in his aquis indolem vel sic præcipue manere, una cum virtute propria, odor, Sapor, Effectusque docent.

6 — — — — — — — —

— — — — Quæ Sane eximia est Chemiæ potentia. Dixerat Paracelsus, sibi experimentis Scitum, in Melissa hospitari virtutem prorsus propriam, specificatam dicebat, quæ instauraret Se humoribus, corporis humani, instauraret iis jam Senilibus novum juventæ vigorem, atque ratione podagram extirpare valeret. Paria bonus Isaacus Hollandus proferat. Si vera Sunt vivorum dicta, credideris, me hac arte exhibiturum compendiosas vires fortissimas, hujus herbæ in hac aqua, cujus in meipso pulcherimos effectus deprehendi, jejuno ventriculo potæ. Sane in Melancholicis, Hypochondriacis, Hysterics, Chlorosi laborantibus, palpitationi cordis obnoxiis, quoties mala hæc a Spirituum perturbatione magis, quam a materiæ morbifica mole aggesta, pendent, vix par remedium reperies, quamvis pretiosum Sit Satis. Mentha crispa herbam, ter quater, cohobando, redegi in liquorem balsamicum, penetrabilem, qui in roborando debili ventriculo, in frigida, lenta, mucosa, pituita Stomachi, in vomitu hinc orto, in Lienteria remedium dat incomparabilem, promtissime Succurrens

Succurrens laborantibus, id nihil Supra
Quid memorem de aqua, quam ita para
ex limonii corticibus, quæ Sane fragranti
Saporis aromaticotati penetrabiliſſima
Suavitate, flatus, Syncopas, languores, cor
=dis, abnormes motus, ocyſſime depellebat
vel parva copia. Sed et abſynthii rece
=tiſſimi crebra cohobatione parata, quam
feliciter bilis defectum Supplebat, langue
=ti opitulabatur officinæ chylopoieticæ, ver
=mes necabat, pellebat. Sabinæ frondes,
quas coram vobis Sic tractabam, aquam
dedere cohobando paratam, quæ omnes
nervos Simul impetu vix credibili com=
=movebat. Hinc inter Ecbolica, Emenago=
=ga, Hemorrhoidas movendia, calefacientia
remedium pulcherrimum, Si modo ad=
=hibetur, ubi convenit. Nunquam de=
=prædicabo dictæ aquam crebra repeti=
=tione paratam, pro dignitate Satis.
In Epilepticis, Hyſtericis curandis, in ve=
=nere pellendo, in Sudoribus & diaphoreſi
pellendis, quid præſtantius? Taceo aquas,
quas ita confeci de juniperi baccis, de
Thuyæ frondibus, quibus tantum boni
in hydrope curando, de floribus cha=
=mæmeli, in expugnanda Tertiana. —
— — — — — — — —
— — — — — — — —
— — — Has ergo (regulas) vobis propono.
I. Herbæ aromaticæ, balſamicæ, oleoſæ,
reſinoſæ, reſinoſo-gummoſæ, graveolentes,
atque id comodum propria fragrantia,
imprimis tenaces; quales pro exemplo Sunt
Arbor, Aurantium, Hyſſopus, Juniperus,
Laurus

urus, Majorana, Melissa, Mentha, Origanum,
inus, Pulegium, Rosmarinus, Salvia: ha, in-
uani, et Similes in umbra benitur Siccatas
arum, dein Sufficienti, Supra definita, copia
qua per Septuaginta horas, vase clauso, calore
50 graduum digesta, deinde autem lege artis
estillata, dant aquas optimas.

. Quando autem aqua desiderantur ex cortici-
us, Lignis, Radicibus, Seminibus, valde densis,
onderosis, resinosis, rigidissimis, tenacissimis, tum
ebent hac prius per tres, quatuor, pluresve, Sep-
manas, calore 96 graduum, vasis perfecte
lausis, cum idonia aquae copia Salsa, foveri,
acerari: ut aperiantur ad feliciorem destilla-
tionem. Sal vero marinus additur tam co-
iosus: partim ut tarde magis aperiantur, Sed
nprimis, quo cohibeantur a putrefactione,
ua aliter tam longo temporis Spatio, huc
equisito, in hoc necessario calore, certo con-
ingeret, odorem, Saporem, vires quaesitas,
orsus perderet. Sic v.g. ex ligno Aquilachi,
Sphalathi, Buxi, Cedri, guaiaci, Juniperi,
Rhodii, Similibus, aqua tales elici debent.

Herbae, quae late Italiam odorem Spargunt,
brevique illum perdunt, debent illico, post-
quam apta tempestate lectae sunt, destilla-
tioni committi, neque ulla digestione ju-
vantur. Borrago, Buglossum, Jasmina
lia alba, Lilia convallium, Philadelphus,
ofa, Tiliae flos, non ferunt calorem,
igestionem, moram. Sed & ligna talia
antur: Sane Scobs vasi Saffafras, si aqua in-
quit, brevi vires, odorem Saporem, Saporem
rdit; Guajacum diu ebullicne decoctum red.
it melius.

4. Vires

4. Vires plantarum, adstringentes, alentes, antalcalina, antiseptica, consolidantes, demulcentes, emollientes, farinosa, gelatinosa, refrigerantes, Stiptica, nunquam hac arte aquis his communicari queunt; sed quaerenda in tota planta compage, vel in parte ejusdem fixiore. — — —

— — — — — —

5. Aliter longe se res habet in illis herbis, quarum vere cognita virtus unice haeret in illa parte plantae, quae calore non excedente 214 gradus Surfum separari a planta potest: ibi enim in aquis his, vitae paratis, omnis illa desiderata facultas sedet; quae decoctis, extractisque, perit. Sane virtutes adeo laudatae in floribus Lavandulae, Liliorum convallium, Rutae herbae, contra eas Epilepticae species, quae abimpetu turbato liquidi nervosi oriuntur, in aqua Stillatitia haeret, decocto, extractoque periit prorsus. Antepileptica Paeoniae vis in decocto manet, in aqua deficit.

6. Reperiuntur plantae medicatae, quarum vires medicinales haerent in parte volatili, dicto caloris gradu, ita tamen, ut, his ablatis per destillationem, adhuc in residua herba, ejusdemque decocto, remanent aliae virtutes, etiam facultate medicinali dotatae: quare neutiquam abjiciendum est hoc posterum, decoctum; verum illud moderato calore, lato vase, inspissandum ut incorruptum servari queat. Hocque postea miscendum erit cum illa aqua; unde tum ambae virtutes adunatae potestatem plantae exhibent. Absinthium Artemisia, Carduus benedictus, Centaurium minus, Chamaedrys, chamaemelum, chamaepitis, Rosmarinus, Salvia, Scordium, & multae aliae herbae huc referuntur.

Processus XVII.

Aqua Stillatitia vulgaris per vesicam, herba recentis, Rosmarini fermentata, more Ludoviciano.

— — — —

impositu pruna in testa sub levissima cineris crusta sopita, ut in liquore & herba calor oriatur graduum octuaginta fere. Qui semel natus dein superjectis stragulis ita conservetur perpetuus idem moderatione ignis. (Sed) astuante cœlo, calor sponte aut satis magnus, aut parvo tantum incitamento egens, erit. — fermentatio hæc, in calore præfinito quinto fere aut sexto die, satis fuerit provecta.

2. Simulac fermentatio duravit tamdiu ut sursum elata prius herba incipiat subsidere, & deorsum labi ad fundum vasis, tam satis ad hoc opus provecta est fermentatio. Hinc tum vas hoc frigefaciendum, arctiusque obturandum. — — — — — — — — — —

3. Accipiatur tantam de hac herba, & liquore ejusdem fermentato, quantum sufficit ad ahenum destillatorium replendum ad duas tertias. Fiat deinde cauta in initio ~~fermentato~~ distillatio

Processus XXIII.

Olea Stillatitia per vesicam, Essentia= lia vulgo dicta, de foliis, vel fronde virídi, Sabina.

1. Huic quidem operi apta planta quacunque magis Scilicet, minusve. Omnium autem maxime illa in quibus aromatica virtus prædominatur, jam descripta processu I. 15. 16. 17, nulla iterum ex his huic operæ eliguntur potius, quam ipsa, quarum odor fragrantissimus, Sapor autem acris, calidus, gratus. — — — — — — — —

2. Folia plantarum Semperviventium aromatica, ut Abietis, Arboris vita, Auvantia, Buxi, Cedri, Citrea, Hederæ, Juniperi, Lauri, Limonia, Mari Syriaci, Myrti, Pini, Rosmarinæ Sabina, Salvia, Serpilli, Thymi, Sunt fere Semper oleo plena. Sed maxime autumno, hyemeq, versus.

3. Folia vero Annua, aromatica, Sponte pereuntia, quæ tamen viridia valde odorata, aroma dives Spirant, debent, pro hac opere carpi eo tempore, quo perfecta adoleverunt & jamjam incipérent declinare ab apice Sui vigoris. — —

4. Experimentorum eventu constitit, folia hæc notato tempore carpta, dedisse plus olei Si ante destillationem fuissent prius aliquamdiu siccata in umbra, (Sed aliter in quibusdam)

5. Tum folia viridia Spontæ, sine tritu, statim, prodiga sua fragrantia, demittuntur in ahenum ad duas tertias replendum, superaffunditur aqua stillatitia ejusdem plantæ, tamque potest ilico instituï destillatio. Abrotanum, Ageratum, Anethum, Calaminthæ, Cochlearia, Dictamnus, Faniculum, Levisticum, Majorana, Marum Syrorum, Mentha, Melissa, Origanum, Sabina, Salvia, Satureja, Serpillum, Tanacetum, Thymus, Thuya, olea sua optime præbent. — — — — — —

— — — ita enim si olea abundantia, & pulcherima, desideratis de foliis, Abietis, Aurantiæ, Buxi, Calami aromatici, Cedri, Chamæmeli, Citreæ, Hissopi, Juniperi, Lauri, Limoniæ, Myrti, Pini, tum his leniissime siccatis, reple vesicam destillatoriam ad duas tertias, affunde ad eandem altitudinem aquam illorum stillatitiam, & ad singulas libras aquæ, semiunciam salis marini, aut drachmam olei vitrioli, relinque vasis arctissime clausis per tres septimanas in calore 90 graduum, priusquam applices destillationi. — — — —

6. Deinde ergo fiat destillatio ut in aqua processus 15. satis, superque monui; ea tamen lege, ut quam promptissime statim ebullitat materies, sicque satis fortitas destillet. Sic enim statim ascendet cum aqua prima oleum qualitatum, ubi e contrario, si lente nimis instituitur destillatio — — — aquam egregie acuit, olei interim copia imminuta.

Artifices) Tandemque observaverunt, flores undecim, aut ultra, dierum Spatio, vasis clausis digestos, addita tanta olei vitrioli copia ut putrescere interim non possent, edisse tertiam partem plus olei optimi, —

Processus XXVI. Pag. 97.

Olea Stillatitia de Seminibus. Foniculi.

— —

2. Semina haec legenda absolute matura: Dein loco perflato tres Septimanas siccanda; cum Spatio triduano cum aqua calida, Salsa, vasis bene clausis digerenda. Dein fiat destillatio eadem lege ut in aquis, nisi quod aequiratur paulo fortior ebullitio; quia alter oleum haud ita bene, vel pronte adscendit. Tincque rursum, Myria loco aqua ad destillandum affusa, calidiore hocce vehiculo vectus adscendit, purior que evadit inter destillandum.

— — — —

— — Semina (quorum olea) obnoxia sunt huic congelationi (inter destillandum) imprimis habentur Anisi, Cardamomi, Cari, Foniculi, Lauri, Zedoaria, . — — — — — —

duodecuplo aqua destillantur ol. Cariophyll.

7. In oleis his essentialibus aromaticis, Virtus inest vix imitabilis, qua unice pendet semper ab illo Spiritu jam totties deprædicato, quæ est acris, inflammans grata, vificiens, calefaciens Spiritus animales excitans, lentorem attenuans, fibras nervosas stimulans. Hac facultate juvant frigidos, Senes, pituitosos, aquosos, febre intermittente frigida laborantes, hypochondriacos humidos, frigidos, hystericas frigidas, aquosas, pituitosas, flatulentias frigidas, aquosas, mucosas, cum talibus dolori-bus acidis frigidis, tam illiacis, quam colicis. Atque prudenti Medico, in his definitis malis, caute usurpata, sunt generosa valde & potentia, imo Secura quoque remedia. Quoties vero adhibentur ad morbos, in quibus calor, motus, inflammatio, nimis increscunt, venena evadunt usu malo. — — —

— — — — — —

— Quæ quidem omnia dum perficiunt, lentores igitur attenuant, dissolvunt, quatenus id aucto vitali motu, absolvi potuerit. Sed engravata virtutes, communes fere omnibus hisce oleis, tantum varia quoad diversos gradus acrimonia. Atqui alia sunt vires, haud minus notabiles, quæ Spiritibus his Singularibus provius Singulares sunt, de quibus jam in aquis Stillatitiis, imprimis cohobatis, satis dixi. Oleum arboris vitæ, Sabinaque, emmenagogum fortissimum, ubi languor Solus retentionem creat. Rutæ oleum epilepsiam a laxo frigidoque, dum curat, simul antihystericum eximium quoties id

mali

nali frigida de causa. Scorbuto frigido, deque oriundis corporibus, tandemque dolo-ibus, juniperi de baccis paratum oleum signi auxilio, atque ab hac inertia ortos re-um infarctus quam pulchre curat! Men-ha oleum languorem ventriculi fere paralytici superat. Paralysin, Vertigi-nem, lethargum, alia cerebri mala, ab impotentia frigida orta, Lavandula oleum quam pulchre sanat? Dum Rosarum oleum lata fragrantia, sine calovis noxia, blandissime cor exhilarat ama-na hilaritatis diffusione. At oleo Cinnamomi suppar videri necdum con-tigit, quotiescunque collapsa gravidarum, parturientium, puerperarum, vires absque inflammatione absque ruptis, hac tenuisque hiulcis vasis. Absinthii, car-dui benedicti, Centaurii minoris, cha-memeli, Tanaceti, olea, mica panis in catapotia si redegeris, sicque jejuno diu-rius ingesseris bihorio ante cibum, quam certum habebis ad lumbricos remedium? Sic practicissimum Melissa, & nobile corticum limoniorum, ad palpitationes cordis ab aquoso frigido, & inerti mucoso, ortas felicissime adhibemus. Majorana, Rosmarini, Salvia muco tenaci uteri frigidoque ejusdem destillationi, singula-re, pulchrumque est.

Si Olea hac cum Salis marini, purissimi, siccissimi, triplo diu, & fortiter conterantur, et bene divisa sint, tumque destillant denuo ex aqua, per vesicam, evadunt defecata pura, limpida, aquae mucilagine quasi gummosa sua liberata, hinc aptiora diutius incorrupta serva-ri, si tum vasis vitreis non nimium alcalicis, arcte colla-

arcto collo instructis, operculo, vel epistomio vitreo accurate adaptato obturatis, in loco frigido, siccoque, servanda reponuntur. Interim tamen in hac depuratione minuitur copia: quia multum spiffi remanet in vesica, quod ob tenacitatem nequit ascendere. Sed et imminuuntur vires, qua a spiritibus pendent: quoniam in aqua, cum qua destillatio instituitur, manent; & in aqua, quæ simul ascendit, etiam dissipantur. Quod caro ostendit, at claro, labore Hombergius, dum oleum tale, vigesies et sexies, destillans, cum nova semper aqua, tandem acquisivit tantum quartam priores. Sodrans transivit in insipidum tenax. Aqua vero vigesies & quater cohobata semper cum illo oleo, acerrima aromatica salina vel spirituosa evasit.

10. Qui olea hac destillabant a creta purissima vasis puris reperverunt, quod uncias quinque olei octies destillatas cohobando supra cretæ unciis quindecim; retinuerint tantum uncias binas & drachmam olei; salis drachmas duas, grana quadraginta quinque; aquæ fortissimæ salinæ sesquunciam; in qua sal volatilis olei.

11. Olea iterum destillata a calce viva, qua extincta in aere, postea vero aridissima reddita fuit, sic mutantur, ut ex libra una olei sexies destillata cohobando extrema vi ignis supra recentem calcem, educta fuerint aqua uncia quindecim cum semisse, uncia una olei! ——

12. Hoc certius afferere ausim oleorum horum pulcherrima, in alcohole vini Soluta, digesta, leni igne, certum graduum destillata, emittere cum Alcohole Spiritum suum hecto-rem, relicto in fundo oleoso tenaci. Hoc si denuo tractatur similiter cum alcohole novo. iterum emittit Spiritus. Sicque manebit ultimo inersus, inodorum, insipidum, spissum, tenax; olei corpus, in fundo, spoliatum prorsus omni Spiritu. Quinetiam aqua pura diu cum tali oleo conquassata rapit in se hunc Spiritum, unde impregnatus opulente, pervat autem oleum. Quod ubi pariter repetitur sepius, tandem simile residuum olei superevit. Hinc parantur pulcherima. Scitusque dividi olea hac in Spiritus & olea; Salem paucum, & aquam, terram quamplurimam; aut utique hac inde produci destillatione.

13. Iterum ergo firmatur tota hac historia. 1. Odorem, saporemque plantarum singularem, in solo hoc Spiritu habere. 2. Odorem, saporemque aquarum stillatitiarum aromaticarum, in solo hoc Spiritu contineri, quatenus cuique planta propria est. 3. In oleis essentialibus quoque solos Spiritus proprietatem exprimere. 4. Oleum volatile planto maxime servire Spiritibus vinciendis: Oleum fixius autem conglutinandis partibus solidis inter se; hinc etiam quam maxime differre. 5. Olea prælla, & stillatitia, jam explicata, satis naturalia esse ipsis plantis. 6. Oleorum autem discrimen imprimis esse a Spiritibus.

Helmontius vere docuit decoctum baccarum juniperi ab educto superstes olea vives habere purgandi pulcherrimas, si idonea modo copia bibitur.

7. Ex hoc experimento clare patet. 1. Calorem Summum Solis, continuatum diu, posse cogere & mutare olea liquida Venetum, per gradus varios Spissitudinis, tandem in resina, vel colophonia dura Speciem. 2. Calorem ebullientis aquae cito id efficere coctu olei, relinquentis colophonium in fundo aheni, intra quatuor vel quinque horas. Tunque fumum egredientem esse aquam acidam Spiritum, & intermistum ingenti copia oleum. Colophoniam manere manere duram. 3. Hanc colophoniam, actam calore ducentorum & octuaginta graduum, iterum verti in aquam acidam, & oleum rubrum tenax, ponderosum, atque remanere dein colophoniam valde duram, pellucidam, atrorubentem, constantissimam per Secula. Atque tandem hanc ipsam iterum igne Suppressionis auctum ultimo in gradum, unde fere liquesceret vitrum, totam quantam verti Sola vi ignis in materiam oleosam liquidam, tenacem quidem, attamen liquidam iterum, Sine colophonia dura relicta. 4. Unde &c. — — — — — — — —

Pag. 134. deflillatio Cerae.

2. Scindatur optima talis cera in fragmenta tam parva, ut iis per patulum os retortae immissis repleri queat ad dimidium. Tum infunditur retortae arena purissima in repletionem retortae usque. Calefiat tam lente retorta, donec cera liquefacta arenam sibi permiscuerit, & imbiberit Satis. Tum impone arenae in furno, applica recipiens.

3. Fiat deflillatio per gradus. Exire Solet

olet primo aqua acidula, ingratissimo ni-
ore foetens, pauca, una cum Spiritu.
1. Ubi leniore ignis gradu 214, nihil ampli-
us exit; mutetur recipiens. Augeatur ignis,
scendit Sensim oleum tenue, dum destillat,
in excipulo concrescens instar butyri, colore
lere albescente. Ubi ultra prodire negat,
pplicetur ignis fortissimus Suppressionis:
um ascendit Satis Subitó tota massa
cera in excipulum; ubi forma Solida con-
sistit instar butyri. — — —
— — — manet hoc butyrum Semper
molle vel in Summo frigore: & cera dura
inde tempore diuturno iterum non nascitur.
— — — pag. 136.
— — —
Butyrum Cero ita paratum, probat un-
guentum mollissimum, anodinum, nervoti-
cum, emollientissimum, laxans, illita Suo
contracta membra juvans, cutim contra
rigiditatem aridam, fissilem, frigidam,
hybernam feliciissime defendens. Haemor-
rhoidum asperos dolores pulcherrime
lenit.

{Hujus butyri destillatio

Hocce butyro, ad dimidiam partem, sit
retorta repleta. — — — Retorta haec
imponatur furno arenae, agglutinato
recipiente puro. Tum fiat destillatio
Summa cum prudentia ignem ita guber-
nando, ut guttatim destillet, labentibus
guttis ad intervalla Sex minutorum Secundo-
rum circiter. — — — Sicque pergendum
erit tamdiu, aucto Semper Secundum hanc
conditionem igne, quamdiu aliquid de Buty-
ro in retorta Supersit. Ascendet hac vi
one

vatione omne butyrum, fere sine ulla face: Haerebitque in excipulo oleum, spissius tamen, loco butyri, non multam imminuta copia. Si hoc oleum cera, iterata hac destillatione, ita paratum, rursus nova destillatione, eodem modo, destillat, evadet semper liquidius, mollius, pellucidius, tenuius, sic ut tandem limpidum, subtile, oleum refert. Quoque saepius sic repetitus destillatio, eo semper lenius, mitius, & tamen penetrabilius, evit. — — — —

— — Oleum cera, hoc ultimum, remedium est incomparabile prorsus, ad mala papillarum nervosarum, quae in cute extrema occurrunt. Nam in curandis fissuris labiorum hybernis, in fissuris papillarum in lactantibus, indigitorum, manuumque rhagadibus, vix aliud habet simile, si subinde levi illitu applicatur. Ad tamores frigidos hybernos, faciem, digitosve, infestantes, discutiendos paritur locum habet. Ad tendines contractos, hinc obrigescentes articulos, cum balneis, fomentis, motu, hoc oleum valet mirifice, flexilitatem restituendo. Abdominis crebra inunctio facta de hoc oleo adstrictae alvo lubricitatem conciliat, hinc in infantium morbis percurandis nobile.

pag. 210. Resina, adhibenda, prius in mortario vitreo, frigido, terantur diu, cum sacchari sicci aqua copia, ut pulvis ita paratus minutissimus, qui dein ex syrupo quodam quam obhaesit viarum plicis. hausitus, nunquam transit non dissolutus nun-

Extracta, quo vocantur essentialia, de Croco.

2. Accipe Croci lectissimi, recentissimi, Brittannici, Sicci, uncias binas. Immitte in phialam vitream longo instructam & angusto collo. Superfunde Alcoholis purissimi, ut emineat ad quatuor, vel Sex, digitos in ampulla ~~ph~~ vitrea. Tum Orificium colli obtura corio papyraceo, molliter impresso. Relinque in digestione triduana, calore centum graduum Sepe concutiendo. Quiescant viginti quatuor horis in frigido, & quieto loco. Tum Sollicite, per lintheum rarum infundibulo impositum, transfunde omnem liquorem tinctum in vitrum purissimum, & arcte obturato vase Serva, erit coloris fulgentissimi. Croco in fundo phialae tantundem novi alcoholis affunde, tracta eodem modo. Liquorem hunc confunde simili ratione cum priore, & Serva.

3. Alcohol tinctum, ex alta cucurbita vitrea, igne centum graduum, vasis bene clausis, destillet quam leniissime donec circiter uncia in fundo cucurbitae supersit. Frigida haec effundatur in vas vitreum quam curatissime obturandum. Erit coloris rubervimi odoris fragrantissimi, Saporis amari, aromatici, penetrantissimi, Spissitudinis olei liquidi. Spiritus Servare Soleo in eosdem usus posea.

1. Hoc extractum est prorsus singulare quid & patitur se miscere aquae, Spiritui, oleo. Vires habet Latificas adeo, ut in risum fere perpetuum & indecorum, nimis usus adigat. Moderato usu rerum exhibet exhilerans. Lotium tingit colore rubro, Satis. — — — ultimo his inest virtus ita admirabilis, quam seminavit in his Natura conditor, quaque nullo ex principio unquam explicari potest, tantum vero Se Solo cognosci.

2. Ambarum griseum vocatum, Moschum, Zibetha, castoreum, Balsamus Peruchuntanus, Mechanus, Liquidambar, Styrax liquida, Caryophylli hortenses, caryophylli Indi, macis, Nux Myristica, Angelica, Galanga, Imperatoria, Iris Florentina odorata, cortices, Flores Subtilissima fragrantia, Similia profusis exhibere possunt eadem hacce methodo. Ut omnino pateat, Spiritus illos corporum singularium Alcohole elici, extrahi, colligi. Hincque videtur nasci promptissima illa actio horum: quia Alcohol Spiritu-ossimum, unitum Spiritibus hisce actuossimis, constituit medicamen, quod virtutem celerrime diffundit quaquaversum, & defert, per corpus. — —

3. — — — — — — —

— — Sumuntur hæc extracta omnium optime ex Vino Canarino, Hispanico, aut simili, oleoso, pingui.

Quinta Essentia Chemicorum Dicta.

1. Olea, optima, Stillatitia, aromatica, Essentialia dicta, dimitte in vitrum purissimum, siccissimumque; illis dein affunde duodecuplum tantum tantum Alcoholis omnium purissimi, ideoque imprimis alcalisati, dein destillati, omnino aquæ ut contineat nihil; conquassa simul, disparebit oleum, miscebiturque ita intime Alcoholi, ut appareat unum simpliciissimum, liquidum, limpidum, pellucidum. Oportet nill aquæ in oleo sit, aut non fit.

3. Si Alcohol

3. Si Alcohol, oleo Soluto Saturum, vasis cu-
ratissime clausis, igne leni destillat, atque
cohobatur aliquoties, tum Sensim oleum red-
ditur volatile adeo, ut magnam partem ascen-
dat una cum alcohole: unde olea tum mobili-
ora, Subtiliora, evadunt, atque evehuntur in
Summam penetrabilitatem, Spiritus Similem,
retenta dote nativa.

4. Iterum vero, Si igne nonaginta modo
graduum, mistum Alcohol cum his oleis
destillas, assurget Alcohol vini Solum,
Secum rapiens Spiritum rectorem ex illo
oleo; parte oleosa in fundo relicta. Sique
Subtiliter, & magno cum ingenio, ita tenue a Spisso
Separas, aliquoties leviissime cohobando, tan-
dem accipies liquorem Alcoholis ita impreg-
natum his Spiritibus, ut fere puri puti Spiri-
tus appareant; Olei Spissamine effato.

Sane de oleo cinnamomi ita parata
unica guttula vino Hispanico dilute, bibenti
inspirat gratam Spirituum labescentium
excitationem momentaneam. Hinc in deliquio,
Segnitie, Suffocatione, defectu Spirituum, Sum-
mum inter omnia remedium; neque enim no-
vimus, in vegetabilibus produci posse artis ef-
fectu chemica ulteriius vires medicatas.

In omnibus his, ita paratis, affinitas
magna obtinet cum igne: nam assumpta
hæc Quinta Essentia, intra corpus viventis,
illud calefaciunt; majori copia imprudenter
ingesta, excutiunt corpus. Externe si ap-
plicentur, omnia effecta inflammationes
satis acutas producunt, usque ad Gangrænam.

Quinta Essentia Sicca parata cum Saccharo.

1. Sumito Alcohol cum oleo aromatico Selectum, id affunde decuplato Saccharo conico Siccissimo in pollinem Subtilissimum contrito, conteresimul in mortario vitreo, quam accuratissime, & diu, ut uniantur. Miscela ponatur in vase porcellano, intra cucurbitam puram vitream, qua undique modice calefiat; ut Sic Superfles Spiritus, humectans, leniissime exhalet, atque impositio alembico colligi queat in quintam Essentiam liquidam. Manebit in vasculo porcellano Saccharum Siccum impregnatum quinta Essentia quasita liquida. Hoc Statim vasculis vitreis arctissime claudendis Servavi potevit titulo praescripto. Si capitur floris Subtilissimi farina Tritici drachma, Sacchari conici drachmae adduntur quinque, terruntur Siccissima in mortario vitreo, affunditur quinta Essentia liquida drachma una. Paratur ut prius; obtinebitur quinta Essentia talis elegantissima.

2. Si Sumitur quinta Essentia liquida drachma, Extracti Essentialis Semidrachma, Saccari & floris farinae, utriusque tres drachmae, parantur ut prius, habebitur remedium idem fere, Sed compositum.

— — — Si enim Scrupulus talis parati vini Hispanici unciae permisceatur, hausta dabit, in quo Summa virtus, ab aromaticis quaerenda, dominatur.

Spiritus aromaticus Simplex, de Floribus Lavandula.

1. Accipe florum Lavandula recentissimorum, maturorum, tempore calido, Sereno, post meridiem carptorum uncias Sex Sp. Vini communis libras duodecim, destilla lege artis per Serpentem tamdiu donec incipiat prodire liquor aqueosus albus. Liquor limpidus Seorsum Serva, dein libram unam destillando collige liquoris aquosi, & Seorsum Serva. Prior Liquor Lavandula Spiritus, posterior aqua.

2. Accipe Florum Lavandula Similium uncias tres, his affunde Spiritum praecedentem, & aquam, qua exiverunt; destilla ut prius, Spiritum, pellucidum, purum, hunc Seorsum Serva, titula Spt. Lavand. duplicati; de aqua alba Succedente, destilla nihil; metu empyreumatis. Poteris tamen novam aquam eis affundere ad duas libras, & dein unam Libram destillare. quae Servire poterit aliis, Similibus, destillationibus iterandis.

3. Eadem ratione Florum recentium uncias binas adhuc destillare poteris cum praecedenti Spiritu duplicato, & aqua illa, quatum producta fuit, eritque Spiritus tanto ditior proprio lavandula Spiritu. Repetitione destillationis cum novis Semper floribus, ultimo Spiritus hi quam optimi fiunt. Sape tales Spiritus deduxi in Summam perfectionem. Atque operatio haec universalis habetur pro omnibus pro omnibus Spiritibus de floribus aromaticis paranda. Praecipui Sunt caryophylli hortensis

hortenses, Croci, Jasmini, Lavandulæ, Liliorum alborum, Liliorum convallium, Mari Syriaci, pomorum Aurantiorum, Citreorum, Limaniorum, Rosarum, Rosmarini, Stœchados Tiliæ. Eminet inter hos Spiritus Anthos dictus, celeberrimus titulo Aquæ Reginæ Hungariæ, nimiâ hodie usus ubique. — — Spiritus hi referunt fere integre Quintas Essentias Liquidas (ad pag. 215) patet id evidentissime: quia Spiritus hi bene parati, aqua mixti lacte-scunt.

Tom. II. Pag. 219.

Spiritus aromaticus, Simplex, de foliis siccis Menthæ.

Foliis menthæ crispæ recentissimis, in umbra parum siccatis, dein intra manus contritis aliquantum, affunde in aheno destillatorio vicecuplum Spiritus vini vulgaris. Destilla per Serpentem ad dimidias. Spiritum Serva titulo Spiritus Menthæ. De residuo, quod remansit in aheno, exprime omnem succum per linteum. Sume dimidium prioris copiæ novorum foliorum Menthæ. Affunde Spiritum primum, & omnem succum priorem expressum. Destilla iterum ad dimidias, idque ita repete in vicem tertiam; Serva titulo Spiritus ~~trivitus~~ triplati.

— — — Est hic Menthæ incomparabilis in vomitu sine inflammatione, in flatulento ventriculi, & intestinorum, termine, quido, mucoso, frigido, mucoso, aquoso: his enim in casibus uncia dimidium, præsens dat solamen.

Spiritus aromaticus Compositus.

——— Exemplo igitur potius, quam regula hac servigt, quo sape olim, imprimis pro Sale volatili oleoso, utebar.

℞. recentiss. puriss. Balsamicor.
Corticum Aurantii,
Cinamomi,
Citrei,
Sinens. pomor,
Limon. ana ℥ IV.
Flor. Aurantior,
Citreor.
Limonior.
Lavand.
Rosar. Rubr.
Rosmarini ana ℥ ij
Rad. Angelic.
Iridis Florent. āā ℥ j
Cariophyllor aromat.
Macidis.
Nucis Myristicæ āā dr. ij.
Spt. Vin. rect. ℔ XV. F. S. A. destillatio per vesicam, donec limpidus Spiritus exit, quem seorsum serva. Perge dein adhuc separando libras duas, vel tres, aquam albo. Quam serva titulo Aq. Aromatica Spiritu-osa, composita.

Operatio hac repetere possit ut libet: evant enim tandem (hi Spiritus) instar olei puri.

Sapo de oleis pressis, & Alcali fixo.

Pag. 224.

4. Primo accipiunt Salem alcalinum fixum, igneum cum calce viva paratum, accurate Secundum dicta pag. 53. illum diluunt aqua pura, calida, ea copia, ut lixivium ita paratum possit Sustinere ovum recens. Hoc lixivium Magistra Artificibus appellatur. Dein hujus Magistra portionem pluri aqua diluunt ut, in hoc Secundo lixivio ovum recens ad fundum Submergatur. Lixivium hoc debilius vel Subsequens vocatur. Postea Oleum recens pressum, olivarum, miscetur cum lixivii debilis portione aequali, quantum fieri poterit quam accuratissime: ut albissimum Sit; haec ita simul coquunt lenè igne, bene movendo; donec, donec dissolata imprimis aqua, incoperunt quam optime coire inter Se. Tum vero affunditur magistra, respectu olei, triplum, miscentur, coquuntur tamdiu, donec massa cogatur adeo Spissa, ut pauculum ejus frigido lapidi impositum, forma Solidi debita consistat. Si tamen aliquid hujus frigifacta massula aqua Solvitur, absque ulla apparente olei Specie, apparet oleum Sat is unitum habere ipsi alcalino Sali. Si vero aliqua nota olei adhuc apparet, tunc requiritur, ut Magistra adhuc pauculum admisceatur, porro Simul coquantur, donec

donec æquabiliter aqua dissolvatur confectus Sapo. Gustatur tam Sapo, sique acrem, alcalinum, saporem exhibet; signum erit, nimis alcali abundare, unde tum olei adhuc parum admisceatur, coctio iterum protrahitur; donec ita obtinetur massa in frigore Sciffili duritie constans, in aqua perfecte solubilis, ad linguam non alcaline acris, in aere non sponte decurrens in liquidum. Qui tum verus Sapo appellari meretur.

Tomi. II. Pag. 267.

Urina vetens destillans vasis clausis, dat aquam fatidam, nauseosam, non alcalinam, nec acidam, nec salinam, nec spirituosam ut vina.

Lotium sanorum hominum coctum ex cucurbita vitrea, pura, leni igne centum & quinquaginta graduum, æquabiliter continuato, destillo, donec vigesima modo pars supersit, exit aqua limpida adspectu. Urina autem, ex colore naturali straminis, fit sensim rubicunda, & prout plus aqua pellucida illius adscendit, eo semper profundius rubrum colorem accipit, pergue varios gradus perpetuo altius tincta tandem nigra fere redditur rubra, valde spissa, turbida, opaca, spuma tenax. Prima illa pars limpida fatore ingrato, nauseoso, singulari, non alcalino volatili, distinguitur. Quodque mirum, quamvis sæpenumero iterum destillationem patitur, tamen semper hunc ~~odorem~~ rigorem retinet; quinetiam si in aere aperto diu stat, olet semper, nunquam fatorem illum exuit. — — —

— — — Hoc experimento discimus.

Pars humorum salubrium maxime levis, tenuis, volatilis, est aqua fere elementalis, nisi quod in illa inseparabiliter coheret illud alterum aque leve, tenue volatile, fatidum, putridi quid referens, non natum de salino principio, sed ex oleoso potius, & tamen neutiquam spirituosum, fermentatum, inflammabile. Nulla igitur in iis fermentatio, — — — nulla confectio spirituum talium; qui tam facile ab aqua separari possunt: dum fatidum hoc nulla arte queat separari a sua aqua. Nullus igitur spiritus inflammabilis in nostris humoribus volatilis. Oleum in corpore humano, per vives vita longe volatilius conficitur, quam sal ullus in in eodem corpore; cujus contrarium creditur. Fatidum id oleosum singulare, vix usquam, nisi in perspirabili sanctoriano, sudore, & vapore, qui naturaliter in cavitatibus naturalibus corporis. Spiritus fermentatii vegetabiles, corpori humano ingesti, non eunt ad urina vias. An petant superiora, turbant cerebrum, sensorium commune, originem nervorum? an inde actiones cerebri, & cerebelli, tam mire afficiunt? an et hinc tam facile, potiusque per cutis circumferentiam exhalant de corpore? Hinc & novimus, nullum salem volatilem esse in corpore humano, qui gradu aque ebullientis inde ascendit: quidquid contra sentiunt Autores Chemici & Medici. Nihil alcalini volatilis, aut simplicis, aut oleosi. Acidi volatilis nihil. — — — Factor ille Lotii semper crescit, pro virium incremento, in corpore sano, & decrescit contra. Quo etiam plus labore quis, & motu, corpus exercuerit, eo etiam semper augetur factor, &

& contra. Si in humoribus Spiritus quis dicendus ab acrimonia, volatilitate, levitate, penetrabilitate; is non vinosus, nec Salinus, Sed de oleo corrupto in putredinem similem (Proc. 88. de putrifac. vegetant.) descripta exoritur revera. Pag. 269.

Urina recens, residua post processum praecedentem, non acet, non est alcali, Sed Salsa, fatida, nec tamen vere Saponacea.

Tom. I.I. Pag. 270

Urina recens inspissata ad quadragesimam, Destillans mista avenae triplo, dat Spiritum alcalinum Salem alcalinum volatilem, Oleum fatidissimum, facem Salinam.

Hinc — in maxima copia urina non potui reperire vel granum Salis alcalini fixi.

Pag. 272.

Urina recens inspissata destillat cum Alcali fixo (aequali copia) per alembicum leni igne, imprimis prodibit Spiritus & Sal alcalinus volatilior aqua; tum Si validio agitur igne, Oleum fatidum, flavum, quoque prodit, Sed post Salem hunc.

Urinam Sanorum ad centenas libras, amplo, humili, vepando vase, ebulliendo infriffo, cavendo ne materia pinguis transgrediatur, perdaturque, donec mellis instar crassam materiem paravero. Hanc uberima collectam copia, vase aperto Cylindrico, vitreo, committo, & loco caligo in granario expono per aliquot menses: ut quam optime computrescat pinguis, et olida, massa. Quam dein olla ferrea immitto, cui ingens de terra figulina alembicus agglutinari commode, arcteque, potest. Longo hujus rostro applicatur recipiens ex maximis. Ignis per gradus incenditur, adscendit copia incredibili Sal albus, alcalinus; dein oleum flavum, Salem priorem inquinans, & cum eo Sal quidam priori aliquanto fixior. Urgeo ita tandem, ut olla ferrea incipiat candescere ab igne: quando oleum, & Sal ultimus ascendunt. Refrigerata parum olla ferrea, dum calor adhuc magnus in materia fixa, excipulum auferatur, & omnis elevata pars, vasis vitreis reconditur, accurate obturandis. Quae dein (sicex alto vase, leni igne agitur) in Spiritum, Salem, olea, resolvitur. Id autem quod in fundo vasis remansit, si miscetur cum carbonis lignei duplo, vel triplo, tumque ex vetortis parvis, figulinis, loricatis, urgetur igne summo per spatium sedecim horarum in receptacula aqua plena sic, ut finis rostri vetortae sub aqua recumbat, caerulescentia tandem corpuscula emittit, quae in fundum aquae decidunt: inde colliguntur ita, ut semper tecta sub aqua in vitreo parvo vase haereant. Si tum vas hoc, igni impositum, valde calescit, liquescens

liquescens Phosphori materies non solvitur in hac aqua calida, sed in unam coit massam, instar cerae liquescens, quae sub aqua servata, per annos viginti & ultra, efficax servari potest.

Tom. II. Pag. 286.

— — Sal Ammoniacus hodie conficiunt ex urina Animalium, Camelorum minimè bibacium praeferunt, inspissata partibus decem, Salis marini partibus duabus, Fuliginis optimae lignorum parte una. Quae coquunt in aqua, colant, exsiccant, dein vasis idoneis sublimant, solvunt iterum, depurant, & coagulant.

Pag. 294.

Sali alcalino volatili, purissimo, vel Spiritui ejusdem, — — Spiritum aceti fortissimum & purissimum, paulatim, permisce accurate, ad perfectam saturationem. Liquorem habebis, qui non facile in solidum Salem redigi patiens, sed exhibet penetrabilissimum medicamen.

Liquor hic non modo omnium penetrantissimus, qui corpori humano adhibentur, sed absque corrosione ulla virtutem suam exercet, simulque facultate antiseptica, Salina, putrefactioni humorum pulcherrime resistit: quare forte aliud praestantius apperiens, attenuans, diureticum, sudoriferum, vix impetratur. Extrinsecus autem appositum fomenti instar, summum est discutiens, & resolvens. Maxime omnium

oculorum

Oculariorum morborum; ubi in cornea opaci quid subnascitur, aut in humore aqueo:

Tom II. Pag. 305.

Serum Sanguinis, digestum, putrescit.

Serum Sanguinis, vitro exceptum puro, alto, non clauso, fovetur calore graduum 70, tum incipiet fieri tenuius omni hora, ut spatio trium, quatuorve dierum, decurrat liquefactum, saniosum: ex inodoro fere fœtet, exhalatque Mephitim cadaverosam: de insipido ~~exhalat~~ acquirit fracidam rancedinem horrendam acrem: sique paucis ita detinetur diebus, evasit alkalinum, putridum, intolerabile sensibus nostris: — — — — Si applicatur destillationi, Salem volatilem alcalinum præbet prima vice: prorsus, ut in albumine ovi. Serum igitur sensibus exploratum, quiete, et calore definito, sponte tenuius fit. Itaque in Egrotantis corpore stagnans in vasis obstructis, leni tepore, & tempore, sponte deliquescens, sæpe aperit, quæ obstruxerat; unde in inflammatoriis acutis, corporis calore ad mediocrem reducto, spatio definito dierum meabilitas redit obstruendi.

Serum Sanguinis, in aqua ebullientē, igne sicco, & cum Alcohole, Coit.

Novem decimas ponderis Albuminis ovi recentis, ~~est~~ volatilis calore ebullientis aquæ, et est aqua fere pura, insipida. Sic etiam Septem octavas Sanguinis humani.

Tom II. Pag. 311.

— — — Esse ergo miram diversitatem ignis in Sanguinem pro diversitate graduum, quibus applicatur: infra gradus centum ad quinquaginta attenuat, putrifacit. A centum ad ducentos Septuaginta Sex inspissat. Ab hoc gradu ultra iterum attenuat, reddit volatilia, acria alcalica. — — — —

— — Omnia haec in Sanguine plurium brutorum eadem prorsus inveni.

Pag. 312.

1. Ungulas equi, — — — copia satis magna collectas, in aqua pura maceratas, deinde quam solicitissime mundatas, iterumque siccatas, committe retortae vitreae, pure, fere ad inferiora curvari incipientis colli retortae; pone in furno arenae: applica excipulum ampliſſimum. Junctoras agglutina luto farinae lini. Destillato, primo per gradus leves, sensim augendo. — — —

2. Si Cornu cervinum, annoſiſſimum, siccissimum, in fragmenta majora fractum committitur ollae ferreae in furno accommodatae, cui ampliſſimus alembicus figulinus applicatur bivoſtratus, & excipula quam largiſſima. Tum sollicite per gradus excitetur ignis, prodibunt omnia, fere eadem. Spiritus nempe alcalini, oleoſi pingues, Sal volatilis, oleum leve, Sal paulo fixior, oleum crassum, tenax, piceum. Sed vestabit in fundo, niger carbo solidus friabilis, qui redactus in pulverem, & jejuno homini datus, anthelminthicum praebet optimum.

Solida pars (animalium) destillata (nidore & sapore) tanto horridior, quo olei plus continuit: ideoque cornu Cervi macilentum, in tali destillatione, alia dabit hoc respectu, quam os bubulum plenum medulla. — — Enimvero Spiritus, Salesve, depurati ab oleo, tandem ferme eadem dabunt. Sed neque multum discrimnis reperire potui unquam inter producta ex diversis animalibus: nam ungula Equina, cornua Bubula, Cervinave, Ebur, testudinis tegmina, pili, Sericum, dant eadem. Unde iterum parum refert, quanam ex re producantur hæc, Sola olei confiderationi jam expasita exempta. — — — — — certius est, coctione cum aqua educi posse omnem materiam de Solidis animalium, ex qua destillatio hæc, parat illa omnia. — — — Itaque Sales animalium tam repetita, duiturnaque, coctione cum aqua, nondum alcalicos, nondum volatiles, reddi potuisse. Certum etiam, aerem, aquam, Salem, offa iis expasita, tandem orbare omnino materie animali, qua destillando daret aquam, olea Spiritus: quin offa vetusta, ita penetissime dealbata, expasita destillationi nihil illorum dare, Sed terram Simpliciissimam proferre. putrefactio Scilicet Cætera abstulit.

Id porro amœnum experimentum, quo musculus animalis, verbi gratia, Cor bubulum tandiu coquitur in aqua ~~pura~~, Semper nova, donec plane nihil inde plus in aqua educitur. Tum hoc cor molliter, aqua expressa, inter

manus

manus comprimitur atque agitatur; dein iterum, iterumque, idem repetitur, iterumque coquitur nova cum aqua, membrana externa, tenuissima, cordis ablata, ut pinguia coctu fusa, separari etiam queant. Sic tandem musculum habebis penitus solidum, siccum, non corruptilem, examini fibrarum aptissimum. Imprimis, si prius aquam calidam per coronarias adegeris ope siphonis tamdiu donec illa quam purissime eluevet sanguinem ex arteriis, venisque. Ita nempe sceleton obtinebis illius musculi.

Oleum illius sepius destillatum, limpidius, tenuisque evadit & minus fœtens.
Sed & tum omnia fere ultimo eandem indolem acquirunt, vix distinguend postea inter se.

Sales (& spiritus) volatiles leni igne destillantur, ita sal elevatus depuratur, & in fundo vasis manet oleum & aqua fœtida.
Sales hi, ~~ita~~ melius depurantur ~~sic~~, sublimatione per cretam siccissimam, calidam, in pollinem contritam, & quantitate quadruplo superjectam. Sic leni calore sal omnis albus elevatur, Oleum autem, arida creta retinetur fere totum

Sapo ex sale alcalino puro, vol. & alcohole.

Sume spiritum salis Ammon, tam fortem, ut salis ejusdem pluvinum in fundo non dissolutum maneat: eo immisce æqualis copia, alcohol perfecte purum, & coagulum fit.

Sal volat. Arom. Simplex, Angelica

℞ Rad. Angel. recen. ℥ij Februar. effoss.
Spt. Vini Gemel ℞. ℥24
Sal. Ammoon. — ℥j
Sal. tartar. — ℥ij

Leni igne destilla donec Sal primo egressus totus iterum Solutus, ab ultima aquosa parte ascendente, tum absiste, liquorem Supersitem abjice.

Repetere potes destillationem Spt. Salini prioris unciâ nova radicis.

Sal. Volat. Arom. compos.

℞ Spt. ad pag. 221. ℥24.
Salis Ammon. ℥ij
Sal. Tart. — ℥vi
Misce fiat destill. S. A.

Preparatio Singularis Salis aromatici.

Solvantur in
Alcohol. alcalisati ℥20
Olei Stillat. — ℥j ut Sit quint essentia
cui dein admisce
Salis vol. alcalini puri Sicci ℥jj.
Bene conquassando; ℞ habetur.

Sal vol. Oleos. extemporaneus
℞ Sal. Tart. —— ℥j
Sal. Ammon. — ℥iij
Spt. v. rect. — ℥36.
misce in phiala, ocyssime supernatans liquor est Sal qui quæritur.

2.
℞ Sal. Tart. ℥iij.
Ammon. ℥IX.
ol. Still. arom. ℥j
fiat Sublimatio in capitellum leni igne. Ablato alembico, ferri incurvi ope abrasus Sal elevatus in charta, vel orbe vitreato parum contusus, ocyssime reconditur intra vitrum.

Nitri depuratio, crystallisatio.

1. Nitrum vulgare, venale, Solve in Sextuplo ebullientis aquæ, cola lixivium fervidum. Statim, in vase puro exhalet supra ignem non fumantem, donec pellicula apparet in supremo, repone vas quietum in loco frigido, impositis bacillis ligneis puriſſimis, statim formabuntur prismata hexagona, pellucida, longa. — — —

2. Nitrum Solve in octuplo ebullientis aquæ, ebulliens lixivium depura cola, mox instilla aliquid olei Tartari puriſſimi, permisce accurate, instilla iterum, misce, sic perge, donec a novo affuso amplius haud turbatur. Ebulliat lixivium uno momento horæ, percoletur fervens, donec quam limpidiſſimum evasit. (crystallisatur eodem modo). — — — — formantur prismata similia prioribus. Neque ullo experimento deprehenditur alcali adhærere formatis ita Nitri glebis. Hoc purum est; nec purius effici potest.

3. Lixivium Nitri, superstes de hac crystallisatione prima, diluitur affusa æquali aquæ puriſſimæ copia, coquitur uno momento, fervens colatur, (& crystallisatur eodem modo) Cum lixivio superstite repetitur hæc operatio donec ulterius negat redigi in crystallos. —

I. Acquiritur hac arte Nitrum medicatum, optimum, leve valde, sapore subamarescente singulari, quod assumtum in corpus humanum, facile solvitur, mire refrigerat, sanguinem attenuat, impetus Veneris retundit, colorem sanguini coccineum conciliat, in corpori humano mutatur, nec ut marinus sal, immutabile perstitit. — — — — Partes animalium humido, solidove hoc Nitro condita, ab omne putredine prohibentur, rubra valde manent. Unde in omni morbo inflammatorio, una cum densitate phlogistica sanguinis, est sal attenuans optimus, nimia acrimonia nequaquam lædens, nimio pondere neutiquam noxius; sitim nimis haud excitans, alcalescentiam salis humani, putrefactionem olei ejusdem, certo, & fortunato, impediens.

Sal polychrestus. Pag. 340.

× 2. Accipe Nitri puri, siccissimi, florumque sulphuris optimorum, partes æquales, diu accurate contere in pollinem tenuem, quem prudenter calefacito; ejus scrupulos binos simul injice catillo, igni impositio, & inde candescenti. Orietur celerimo impetu deflagratio. Qua pervacta, adjice tandem ad reliquam materiem, deflagrabit ut prius. Pergatur ita, donec tantum materiæ injeceris, quantum huic operi destinaveras. Erit in fundo catini sal quæsitus.

× 1. Nitro puro intra catillum fuso ad ignem injice sulphuris puriffimi, scrupulum simul. Deflagrabit. Perge tandem infundendo simul, donec injectum sulphuris tantum, quantum nitri fusum erat.

3. Paratus

3. Paratus ita Sal, in vase vitreo dissolvatur in aqua fervide quintuplo. Coletur dum fervet. Atque inspissatus denuo colligatur purus. Erit colore albescente, Sapore amarescente, Sulphureo calido. Indolis ejus, qua in thermis Sal quandoque reperitur. Neutiquam acidus, Sed neque alcalinus. Compositus vero ex Nitro, & Sulphuris igne mutati aliqua parte.

Medici, Parisini imprimis, virtutes hujus Salis in corpore humano bene experti, vocaverunt polychrestum: quia tam multa perficit, quia in variis morbis prodest. Si mane, vacuo ventriculo, ab homine Sano, aqua vigecuplo diluta, bibuntur ejusdem bina drachma, cum leni deambulatione desuper instituta, & superbibuntur dein quatuor vel Sex uncia Seri lactis, graminei, recens spressi, ad tres quatuorve vices, vomitum lenem quandoque ciet, movet alvum frequentius, urinam Semper, Sudorem, quoties eo determinatur, calore, motu, admistu Sudoriferorum. Pituitam attenuat frigidam, mucosam, attenuat pariter densam inflammatoriam; apperit vias; corrigit putrescentem bilem; erigit nimis inertem; Stimulat blande totoque. Inde in chronicis, & in acutis quoque, prudenti adhibitione Sanat. Tertianas quidem exquisitas certo feve tollit, Sine metu recidivæ, Sine obstructione viscerum. Quartanas curat quam Securissime, resolvendo Sensim rebellem harum materiem: quare merito laudabile nomen meruit, obtinuit.

Spt. Nitri. Glauberi ℔ 341.

Nitri purissimi siccissimi, subtilissime triti ℥ 18, affunde olei vitrioli purissimi abomia aqua liberati ℥ vj. (furno arenae destillatur, prudentissime)

Spiritus Nitri dulcis Glauberianus. 344

In alta phiala chemica, sint partes octo Alcoholis perfectissimi, huic dein instilla Spt. Nitri Glauber. paucas guttas simul, permisce. Dein iterum tantundem instilla, permisce: atque ita perge donec octavam partem Spt. Nitri, ratione alcoholis immiscueris; semper conquassando quam accuratissime. Dein digere aliquamdiu: & ex retorta destillato bis, vel ter; & habebis. (Cave iterum a fumis & odore)

Vitriolum Martis cum Tartaro Ludovici. ℔ 384

I. Accipe vitrioli Martis partem unam, Crystallorum Tartari partes quatuor, Aquae pluviae partes viginti, haec simul ebulliant vase vitreo, sepe movendo baculo ligneo, donec sit massa fere consistens, cavendo ambustionem minimam. Dein indatur viala chemica, affundatur Spiritus vini vulgaris, ut emineant quatuor digitos, ebulliant simul spatio horae unius, alteriusve, supernatabit liquor rubev. Effundatur, frigefactus, liquor supernatans & percolatur. Residuum tractatur novo Spiritu ut prius, quandiu tingitur rubedine. Omnes deinde Spiritus simul collecti puri, dant Tincturam ferri medicatam Ludovici.

2. Si residuum, cum decuplo aquae ebullit fortiter, colatur fervide per pannum, idque repetitur

repetitur donec liquor limpidus fit; semper nova aqua coquendo, donec omnis materies soluta, & percolata pura, evasit, dein liquor hic inspissatur ad pelliculam, sicque loco frigido reponitur. Habetur Tartarus martialis, aperiens Ludovicianus, hoc titulo servandus vase clauso.

Tinctura bibitur mane, jejuno ventriculo, pondere drachmæ in sextuplo aquæ diluta, ter repetendo, singulis vicibus uncias iv. seri lactis tenuissimi superbibendo cum levi deambulatione, sine sudore. Id continuatur novem dierum curriculo, magno sæpe bono. Pueris rachiticis, & verminosis, inde cacherticis, pauca gutta, in syrupo vel melle data sufficiunt. Tartarus ille chalybeatus drachma pondere mane hausta sufficit in eosdem usus. Effectus optimus in hisce habetur, si alvus inde leniter mota fæces nigras, vel cinereo colore, educit.

Ferrum Solutum in Vino. Pag. 388.

Ferri communis, recentis, nullo modo rubiginosi, subtiliter limati, unciis duabus, in phiala alta chemica admisce vini rhenani generosissimi uncias viginti quatuor. Digerantur simul calore 200 graduum, per tres quatuorve dies, sæpe concutiendo. Dein requiescant 24 horis; supernatans vinum nigrescens percoletur. Purum vase arctissime clauso servetur. Erit sapore atramenti, subdulcis, stiptici. Recidivo novum vinum eodem modo tractandum affunditur. Prodibit quidem ferratum vinum, at nullo modo conferendum præcedenti: brevi enim id singulare ferro deest, ablatum per vinum separando potius, quam totum metalli corpus ~~solutum~~ solvendo; est tinctura, non solutionis species.

Apparet

Apparet hinc, esse in Ferro partem in hoc leni acido, fermentato, oleoso, vegetabili, Solubilem, alteram quæ non Soluta manet in eodem. Prior pars est Summum remedium, mihi hactenus cognitum in arte & natura, ad instaurandam vim hæmatopoieticam corpori humano, quoties hæc Sola ex debilitate nimis laxorum Solidorum, & humorum nimis levi, aquosa, frigida, inerti, indole exoritur. Si ullo experimento probatur eximia potestas medicata Metallorum, certe hoc unico demonstratur: neque enim ulla rei vegetabilis, animalisve, virtute nulla victus regula, id quis efficiet in casu dicto, quod hoc Marte conficitur. Nocet ubi vires vitæ nimiæ, sive ex firmis, sive ex fluidis. Cogitavi sæpe, hoccine Sulphur effet Metalli potabile debilitati naturæ unice succurrens? jactato auro potabili, hactenus evulgato, infinities melius, nunquam noxium, quoties datur, ubi requiritur. — — — Si hujus vini ferrati 1 drachma, triplo Sacchari ad consistentiam cocti misceatur, certaque lege, in casu idoneo, propinatur, auxilium affert pueris, virginibusque, incomparabile prorsus.

Pag. 421.

3. Si Argenti vivi pars una, cum duplo Salis marini, purissimi, decrepitati, in pollinem tritissimi, ex cucurbita vitrea igne satis forti, horis quinque vel sex, agitur; dein frigefacta, frangitur cucurbita, deprehenditur mercurius Sublimatus, Solidus, Siccus, vera vitrioli forma. Sed & mercurius Sublimatus vulgaris est verum mercurii vitriolum, semivolatile tamen.

pag. 422. Merc. praecipit. albus.

— — — Pulvis hic, ita vite paratus, est forte optimum remedium usque cognitum, quod paratur de mercurio ad usus internos: Efficaciter, satis tuto agit. Si cum Sacchari conici triplo conteritur facit panaceam mercurialem potius, quam forte alia de Mercurio parata quam laboriosissime. — — — — Si datur jejuno, adulto, pulvis Sacchavinus ad novem grana, alvum movet, movet vomitum leviter, vermes occidit, Systema chylopoieticum aperit, liberat, purgat, pituitam solvit, sic morbos plurimos, gonorrheam, scabiem, ulcera venerea, alivae, curat. Si dosis haec aliquoties repetitur quotidie semel, salivationem blande ciet. Si praecipitati albi drachma sesquiuncia unguenti pomati, aut rosati, accurate misceatur, facit medicamen infectis cutaneis evadicandis optimum, tutissimum; & scabiei sanandae aptum, ut et faciei ulcerosae, atque ulceribus cacoethicis persanandis.

Mercurius Sublimatus. Pag 425.

℞. Mercurii in aq. fort. soluti, & in siccam massam albam inspissati, selibram. Salis marini decrepitati uncias decem. & Vitrioli communis ad albedinem calcinati uncias decem. hos binos sales, mortario vitreo, diu, fortiter, seorsum contere, loco sicco, calido, dein accurate misce simul tum et ei admisce mercurium quam accuratissime. Pulverem immitte phiala, cujus venter modo tertiam partem pulvis immissus repleat; collum phiala abscindendum ut septem

Septem modo, aut circiter pollices emineat. Tum phiala ponitur in furno Sabuli ita, ut fundus phiala cavum olla ferrea tangat, arena circumponitur phiala sic, ut modo tam alta sit, ac superficies materia contenta, non supra, nec infra; tum utere leniissimo igne, sensim per minutos gradus aucto, donec per apertum os exhalet vapor, a quo naxio pulmonibus abstinendum. Ubi omnis humiditas exhalavit perfecte, tum charta imposita claudatur os phiala, augeatur tandem ignis eousque, ut olla rubefcat ab igne, elevabitur ad latera in crystallos albas, semipellucidas, Mercurius sublimatus corrosivus.

Granum unum aqua uncia dilutum est remedium cosmeticum prudenter usurpantibus. Venenum omnium infectorum cutaneorum simplici lotura. Si drachma talis mistura, syrupo violaceo mitificata, potatur bis terve in die, mira praestat in multis morbis incurabilibus. At prudenter a prudente medico! abstine si methodum nescis!

Turbith Mercurii. Pag. 427.

I. Argenti vivi puriffimi Unciis quatuor in urinali affunde olei Vitrioli optimi Uncias octo. calefac leniter & forte. calefacta pone supra prunas, ut ebulliat leniissime materies, & fumet; a fumis ut caveatur, oportet sub camino sic disponere, ut vapor dispergi nequeat, aut ad pulmonem pervenire. Incipiet argentum vivum, in olei vitrioli fundo decurrens, solvi, perge eundem ignem suppeditando tamdiu donec omis Mercurius soluta sit. Erit massa nivis

nivis instar candida; hanc dein eodem igne continuato calcina ad siccitatem, ut non fumet amplius. Erit pulvis candidissimus, niveus prorsus, horrendus acer, & intractabilis, vocaturque calx alba mercurii oleo vitrioli facta. Hæc ita fit; sed vix modis vulgo descriptis.

2. Massam siccam, calidam, tere in mortario vitreo in pollinem sublimissimum. Tum præsto sit vas vitreum calida aqua purissima plenum, ut ad minimum vigecuplum aquæ sit, respectu ponderis mercurii. Injice in hoc calcem hanc. concutiatur vas: subsidat quieta pulvis flavus. Effundatur liquor in aliud vas. Pulvis citrineus in fundo affusa calida aqua abluatur, donec sit insipidissimus prorsus. Dein leni igne prorsus exsicca. Hic pulvis grate colorabat est Turpeth Minerale quæsitum.

3. Liquor primus stet aliquamdiu quietus, coletur. Inspissetur ad sextas: Erit Mercurialis aqua.

Analysis Vitrioli. Pag. 436

1. Accipio vitrioli viridis, vulgaris, libras 8. Calcinatur igne gradatim aucto donec liquefit fusum, iterum spissatur, & cinereum colorem induit, & aucto iterum igne materies flavescat, & ad latera jam incipiat rubescere. Frigescant, tunde in pulverem. Erit flavescens. Materies calcinanda tantum tamdiu, quam diu igne amplius non fumabitur. Solet ita prima hac parte operationis perdi pondus librarum trium ex octo, ut de his, quinque superfunt.

2. Libras quinque has contusas destillantur per octodecim horas igne maximo.

Habui plerumque inde olei Vitrioli atri, crassi, fortis, fumantis, Uncias viginti & unam. in vase destillatorio erat calx rubra, nigrescens, levis, pulverulenta, austera, ad uncias quinquaginta duas. Ut quinque Uncia dissilata ~~exant~~. fuerint.

Oleum hoc Vitrioli non ebullit nisi igne fere Sexcentorum graduum. Si autem oleum hoc, cucurbitae vitrea indutum, urgetur igne arena quingentorum graduum, tam demittit de Se Spiritum Suum Sylvestrem, Suffocantem & aquam. Tum ex nigro factum est limpidum.

Ens Veneris. p. 439

1. Recipe Colcothar vesiduum de oleo Vitrioli, calcinatur Crucibulo tecto, igne extremo; Erit hac calcinatione ruberrimum. coque aqua semper nova, bene movendo, donec aqua effusa sit insipida. Tandem Superstes pulvis ruber tenuis servetur titulo Calcis dulcis vitrioli.

2. Accipe Calcis dulcis vitrioli, florum Salis ammoniaci p.e. contere mortario calido, quam diutissime donec intime mista, subacta sint. cavendo ne madescant. Pulverem mistum, inde cucurbitae terrae non nimis altae; Applica alembicum latum, rostro lato, appende excipulum exiguum tam loco furno arena, ut fundus cucurbitae aliam ferream fere tangat. Instrue ignem per gradus, cucurbitae circumdato arenis obruto. dato igne, expulso liquore, ascendet in alembicum flos albus, mox

mox flavus, brevi rubescimus. continuetur ignis per sex horas, ultimo tam validus, ut olla fere rubescat. refrigescant sponte. Flores exempti vitro sicco servantur.

P. 444. Antimonii Regulus cum Salibus.

2. Nitri vulgaris p. II. Tartari boni p. III. Antimonii puri p. IV. bene siccas, seorsum redige in pollinem subtilem. Bein siccissimas conterve diu simul, ut sint intime permixta. Massa sicca fiat calida, mediocriter. Tum crucibulum magnum candefiat ab igne: tum injice drachmas duas, & post perfecte quievit, ingeratas tantandem; & sic perge donec omnem injeceris. tum auge ignem, tecto per tigillum crucibulo, donec fluit materies instar aquæ. Tum effundatur uno rivo in conum fusorium calefactum & sebo illitam, statim concute conum. Quiescant, frigescant; inverte conum, Exiit ictu conus, cujus infima pars metallica Antimonii, superior ex salibus & sulphure.

Antimonii Regulus cum Ferro & Nitro. P. 446
Sumo libræ semissim Ferri recens limati. Cadefacio in crucibulo. Affundo tum Stibii subtilissime triti libram, bene prius siccatam & calefactam. Detineo magno in igne ut penitus fluant. Fluentibus liquidissime, injicio seorsim Nitri calidissimi subtilissime contriti, quartam libræ partem. Detineo in igne summo, donec omnia fluant instar aquæ. Effundo in conum ut in præcedenti. Reguli habentur instar Argenti candidi, Stellati, Uncia septem cum dimidia. Scoriæ sunt longe alterius naturæ, siccæ, duræ, vix deliquescentes ferratæ, sulphureæ, acres, salinæ.

Stibii Solutio.

℞. Antimonii triti ℥ij
Aqua Regiæ — ℥iij.

erit Solutio humida Spissa instar pultis. Hæc leni valde igne, subinde baculo agita, exsiccetur.

Antimonii Sulphur elevatum.

Scoriæ Regul. Ant. Mart. coquuntur in aqua, donec omnes Soluta. Liquori instillatur Acetum, & perge instillando, & movendo, donec nihil amplius præcipitatur. Subsidet effunditur liquor Supernatans; Subsidens affusa aqua eluitur ad insipiditatem perfectam, Exsiccatur leniter. Restat pauca materies. Emeticam habet, Sed blandiorem vim.

Sulphuris Solutio in alcali fixo

℞. Sulph. p. IX. fusis in catillo injice alcali fixi p. II. Siccis. contus. misce, deinde bene fusum & permistum, effunde Supra marmor frigidum: erit massa rubra in aqua Solubilis, in aere cito diffluens.

Spiritus acidus Nitri habet 60 p. aquæ ad 19 p. veri acidi
Spt. Salis habet aquæ partes 52 p. ad 13 p. veri acidi.
Oleum Vitrioli habet aquæ 60 p. ad acidi 37 p.
Tumque ponuntur liquida hæc acida omnium meracissima Tom. II. pag. 364.

Figura ad paginam 727. 728.

Icon. I.

A B C D. Cylindrus Stanneus cavus Sex uncias latus, exeuns in

C D E. Tubum conicum quatuor pedes altum, in vertice E unciam latum.

E F. Tubus Cylindricus, altitudinis quatuor pedum, unciam latus.

F G. productio ejus, ut accommodari queat intra Serpentis in refrigeratorio orificium.

H. I. K. Sustentacula nectentia tubum ad=scendentem, & descendentem, ut firmi sint.

Hoc est Capitellum pro conficiendo Alcohole.

Icon. II. ad pag. 729, 730.

Ampulla vitrea, quarum collum recipit cauda recipitur, quæ nexa inter se, & per luta conglutinata, augent, pro arbitrio, distantiam inter vas Destillatorium & recipiens.

Icon. IV. ad pag. 730, 731.

Pelicani compendium per duas phialas. vel matracias

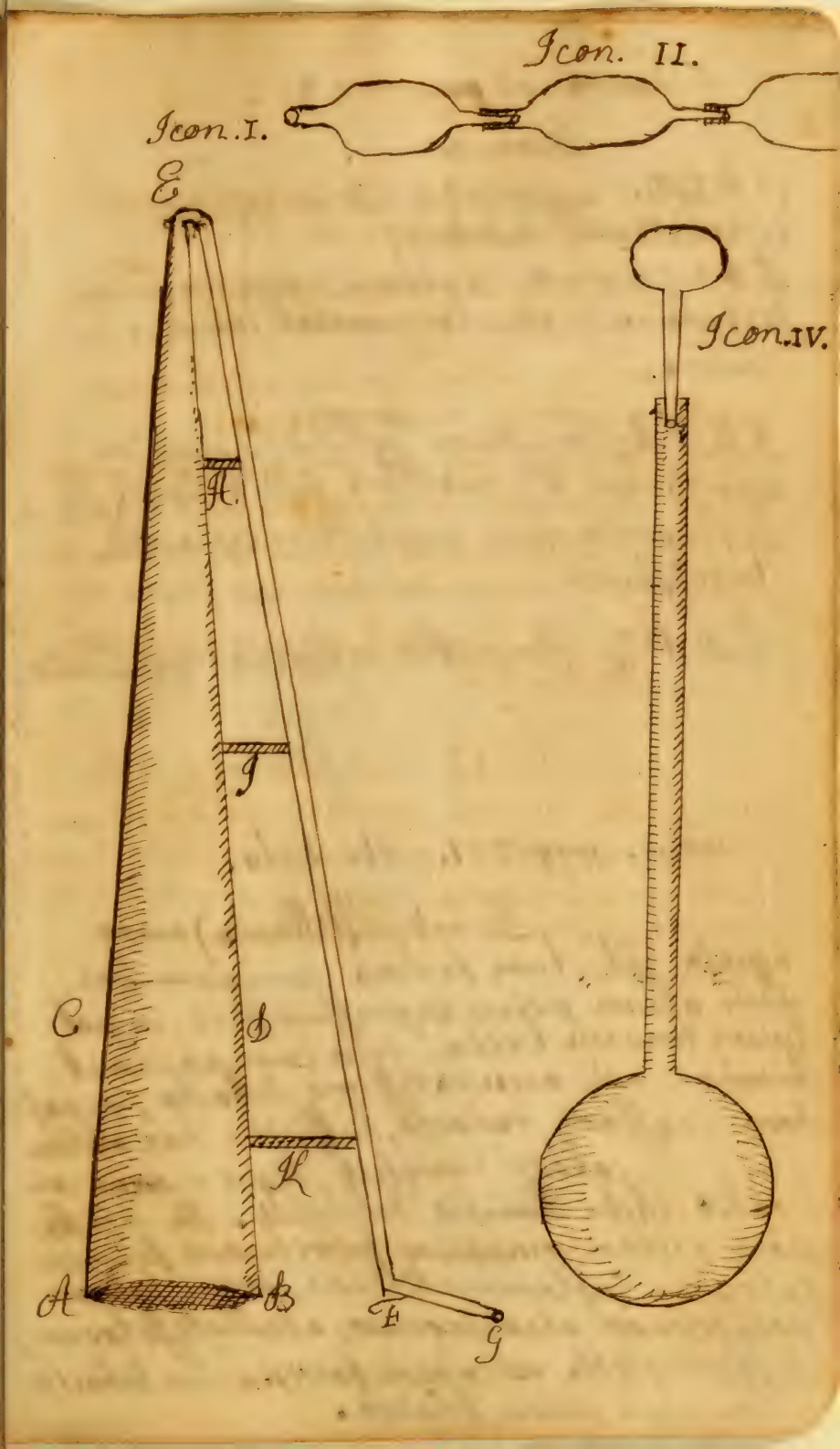
Icon. II.
Icon. I.
E
Icon. IV.
H.
I
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Figura ad pag. 728.

Icon. I.

Totus apparatus, ut in ipso opere deſtillationis habetur.

A B C D E F G H. Cantharus figulinus deſtillatorius, ſitu horizontali locatus in furno.

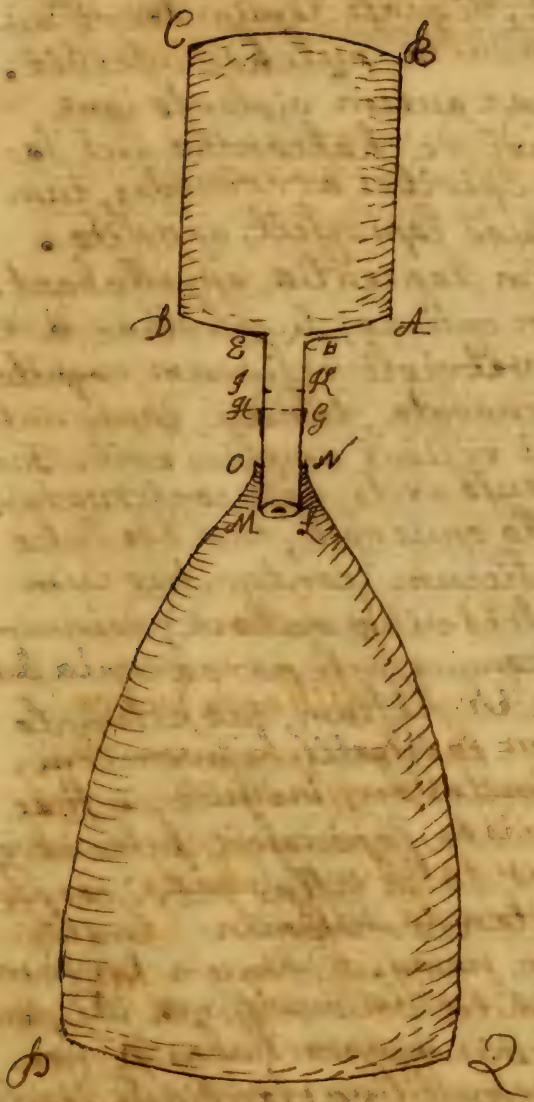
I K M L. Fruſtum Cylindricum in aperturam A G cantheri deſtillatorii, & O N aperturam ampullæ recipientis, immiſſum.

O N P Q. Ampulla recipiens applicata.

Tom. I. pag. 731. De Luto.

— — — — Si res (diſtillanda) mere aquoſa eſt, tum farina ſeminum Lini, unde oleum prius expreſſum fuit, in pollinem tenuem trita, dein cum pauco albumine ovi accuratiſſime ſubacta, in paſtam craſſam redacta, ſufficit: hæc autem — — — — — calore durefit, ſique rimas contrahit illitu ſimilis ſolidefit. In deſtillatione autem omnium ſpirituum fermentatorum inflammabilium, aquæ ſalium volatilium alcalinorum, alcoholiſatorum, ſufficit paſta ex eadem farina diu ſubacta cum aqua pura, frigida.

verum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Verum in destillatione acidorum, vel aceto-
=forum, vel aliorum, gluten hoc non sufficit;
quia exosum solvitur, molleficit, fumantes
spiritus emittit. Vesica tam bubula, aut
suilla, in aqua macerata prius, donec glu-
=tinescere incipit, & quasi semiputrere ad-
=aptata, & circumducta, pulchre inservit.

Quotiescunque autem violento igne
expelluntur acidi de chalcantho, aut sa-
=libus fossilibus, spiritus arrodentes, tam
opus est luto, quod lapideficit, apposito.
Unde illud, Lutum sapientiæ appellabant.
Fit autem quam optime, si colcothar a de-
=stillatione olei vitrioli residuum, coquitur
in aqua, sepe renovata, tamdiu, donec nul-
=lam notam salini residui amplius edit. Tum
exsiccatur, & clauso arcte vase conservatur.
Quando igitur illo opus erit, tam hoc dulce
colcothar, bene siccum, conteritur cum
equali copia calcis vivæ optimæ; deinde cum
albuminis ovi conquassati parva copia sub-
=igitur ocyssime in pastam, quæ extemplo
siccis, paulumque calefactis, vasorum com-
=missorum extremitatibus inducitur. Hæc
chim cito exsiccata lapideficit fere dures-
=cendo, omnesque sales instar vitri coercet.
Interim absque tanto molimine, similis
efficacia lutum paro. Nimirum terram
figulinam misceo arenæ puriffimæ illi pon-
=dere, ut massa per aquam subacta non
amplius adhæresçat tractantium digitis,
huic dein misto calcis communis Comenta-
=riorum unam quartam addo, ut sit pasta satis
spissa.

Hæc

Hac, quo aridior, eo melior, modo ductilis sit, apponitur juncturis connexorum vaso=rum, ubi curescens optima est. Si forte in igne summo, inter destillandum dehiscit, rimasque contrahit, inducta similis statim potest rima operiri. Hoc commodum: quia calx viva sepe haud ita prostat ve=nalis & sincera.

Inter destillandum vero, maxime in furno ferventissimo, ubi vasa ignis astu candescunt, maximum incommodum contingit, quando inter ingerendum novum pabulum, vel aer frigidior, vel ipsa materies ingesta comburenda, frigiditate sua ferit super=ficiem candefacti vasis, quod tum facillime crepans dissilit, finditurque. Hinc quam maxime necessarium est, vasa hac incrusta=re superinducto vestimento, quo munita defendantur ab hoc frigoris subitanei insul=tu. Id quoque sape exigitur, dum destil=lationes peraguntur in vasis vitreis, summo igne arena, ubi vitrum fere disponitur ad liquescendum: ut id caveatur, utque ferme vitrescens materia in crusta illa quodam=modo figatur, aque confluxu ita prohibe=atur. Optima hac, mihi nota, fit crusta, si terra pinguis figulina cum arena contrita in pollinem, cum pura aqua subigitur in pastam accurate permistam qua non amplius lenteficit habendo. Tumque ultimo parum calcis Cementa=ria admistum capiat, ut intime permista sit pasta. Tum enim vas tepefactum & vapori aque expositum, ut tota superficie leviissime madescat, affixa aquabiliter hac

pasta

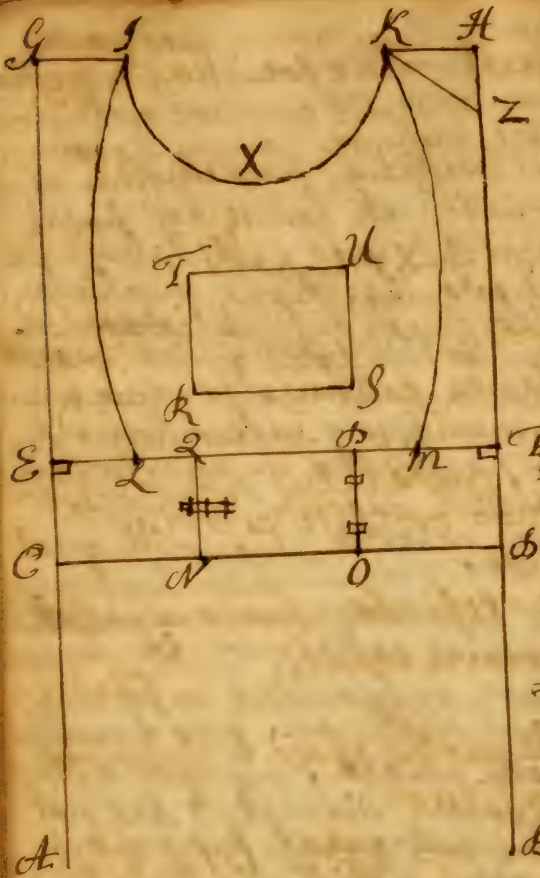
hac pasta undique investitur, palmisque manuum appressis reducitur ad eandem circumquaque crassitiem, prout judicatur utile. Quo facto aspersa est vinsecus arena calida sicca, reponitur in loco fere frigido, ut lentissime exsiccetur lorica induta. Rima forte nata inter exsiccandum implentur eadem impressa materie. Si tam absolute exsiccata omnia fuerint, tunc ignem violentum vasa hac sustinebunt.

Tom. I. pag. 735.

Furnus simplicissimus sic construitur. Ex ligno querno, optimo siccissimo, fit prisma cavum, quadrata basi, novem uncias latum & quatuordecim uncias altum, in eo infigitur quadratus asser, ad altitudinem a basi, quinque pollicum, pollicem crassus, ex eodem ligno, ita ut totum furnulum asser hic dividat in duas partes, inferiorem quinque pollices altam, is focus est; & in superiorem, octo pollices altam, in ea retorta vel cucurbita locantur, ad destillandum. Asser ille medius, diaphragmatis vice fungitur, in medio foramen orbiculare habet diametro quinque pollicum, in quo cavo immittitur fundus rotundus cucurbita vel retortæ. Tum idem asser, extra hunc orbiculum perforatur adhuc quatuor foraminibus orbicularibus diametri pollicaris: ut ignis e foculo possit in secundam partem libere ascendere. Focus ab una latere portam habet versatilem, magnitudinis aperturæ totius foci; adeoque pollices novem latam, quinque altam. — Porta pertunditur, quatuor foraminibus orbicularibus, diametri pollicaris, quibus aptentur epistomia

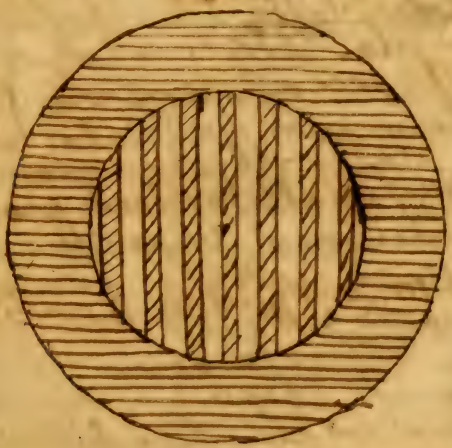
In uno latere, partis superioris, quod porta contiguum est, excisum sit foramen, in medio, quadratum, cujus latus sit quatuor pollicum cum dimidio. Sit tum de eodem ligno, lamina podicaris crassitie, magnitudinis accurata illius foraminis, ut latus, hoc furni accurate claudum sit, pro destillatione ex ex cucurbita, vel pro digestione in phiala, vel pro exhalatione per exsiccationem in vase aperto. atque ita tum tolli queat, quando destillatio ex retorta faciendo erit, tum enim parata esto de eodem ligno eadem lamina, sed in medio suo perforata in aperturam circularem diametri duorum & dimidiati pollicis: ut collum retortae transmitti queat per hanc aperturam. — — Sein Supremum hujus furni valvis biforibus, sursum versatilibus tegitur. Quarum valvarum incumbentium oredium excinditur in foramen orbiculare quinque pollicum: pro transitu cucurbitae, aut colli phialae: denique orbiculus simplex ligneus diametri sex pollicum fiat, qui imponi queat superiori illi foramini quoties destillatio fiet de retorta. —

Sit testa figulina quadrata, infra innitens tribus pedibus semidigitum altis. Tum-des esto planus, latus testae sit exterius 5 pollicum, cum dimidio. Altitudo totius testae esto a fundo furni ad marginem supremum trium digitorum cum dimidiato: tum primo fundo testae cinis cribratus quam leviſſime insperatur ad altitudinem quartae partis pollicis, huic cineri imponitur pruna de cespite Battavo, undique candente, neque amplius fumante: pruna hoc cribrato cinere, leviſſime insperso accurate tecta, aequabilem calorem, corpori humano ferendum, viginti quatuor horis fere sustinet.



Ellipsis, focis distantibus 15 pollicibus, & normali ex foco ad circumferentiam 5 pollices

Sint ad marginem olle superiorem, in margine laterum ibi ambientium quatuor spiraculæ lunatæ figuræ pollicem latæ & in curvatura sua duos pollices longæ, per quæ fumi exitum, & ignis spiramentum habebant.



Turnus Arena pag 738.

AC. BD. Pedes Ferrei duodecim pollices longi.
CNOD Fundus furni ex lamina ferri & aëris diametri XVII. pollicum.
CG.HD. Cylindrus cavus ferreus, super basi CNOD novendecim pollices altus.
EL.MF. Craticula orbiculo ferreo, & ferramentis in medio, Y. Sustentatus ferramentis E & F. parallelus fundo CNOD.
EL. MF. latitudo orbiculi exterioris craticulæ 3½ pollicum.
EC. DF. Distantia craticulæ a fundo 4 pollicum.
NOQP. Porta cineravii mobilis, alta 4, lata 6 pollices.
QRPS. Distantia portæ foci a Suprema Craticula 3 pollicum
RSTV Apertura ostii foci lata 6 pollices, alta 4½.
ILKM. Ellipsis, cujus axis, in focis LM.
IK. 10 pollices, qua formatur, rotatione moduli lignei circa axem cavitas interna foci ellipticoides.
a. Epistomium portæ foci a latere visum.
z. Idem visum desuper
KHZ. Excisio in fossam declivem pro collo declinante Retortæ.
IXK. Olla lata 10, profunda 5. pollices.

E G H F. Interior Elliptico-Conoides, cavitas furni, distantia focorum 20 pollicum, normali in foco ab axe 5 pollicum.

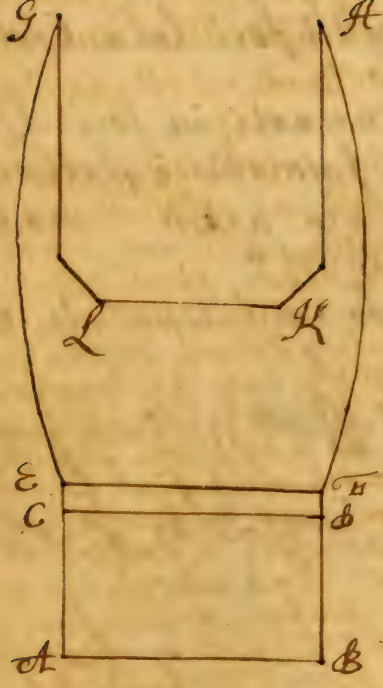
L G. Altitudo vasis 12 pollicum.

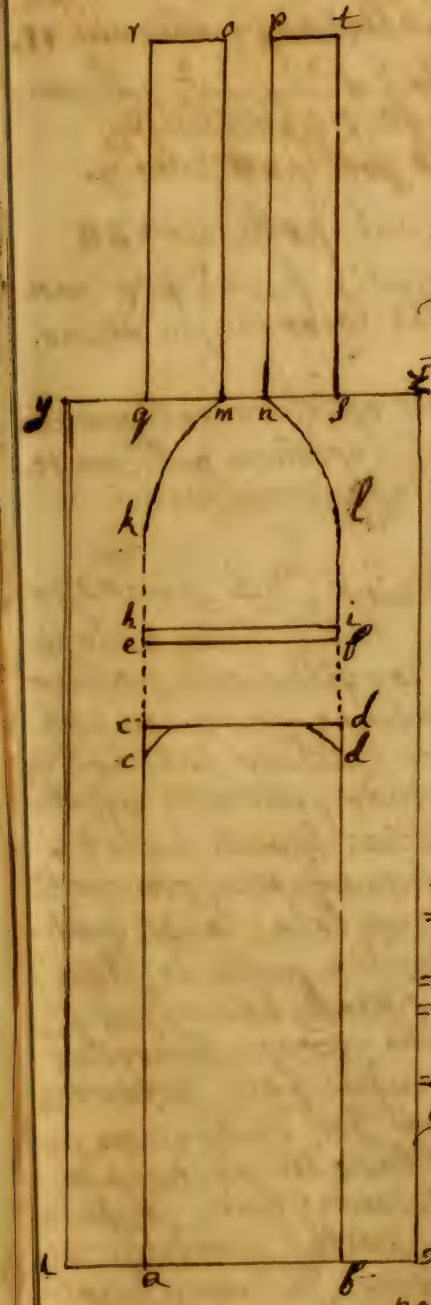
E L. Altitudo a craticula ad fundum vasis, 8. pollic

E C. craticulæ crassities pollicis 1.

A B cineratii latitudo pollicum 10.

A C ejusdem altitudo pollicum 6.





c d ab basis lapidea cava, fornicata ad c d, tres pedes alta.

c d e f. Cinerarium 5 pollices altum, fundo plano.

e f i k. craticula.

a b. c d. h i. k l. latitudo 12 pollicum.

h k. i l. focus 6 pollices altus, usque ad k l.

k m n l. conus paraboloi=des, cujus axis octo pol=lices, ordinatim applicata 6 ex pollices. = ½ k l

m n o p. caminus cylindri=cus, tres pollices latus, duos pedes altus.

Latus rectum parabolæ 4½ pollicum, focus ergo ad distantiam unius, & octavæ partis pollicis a vertice.

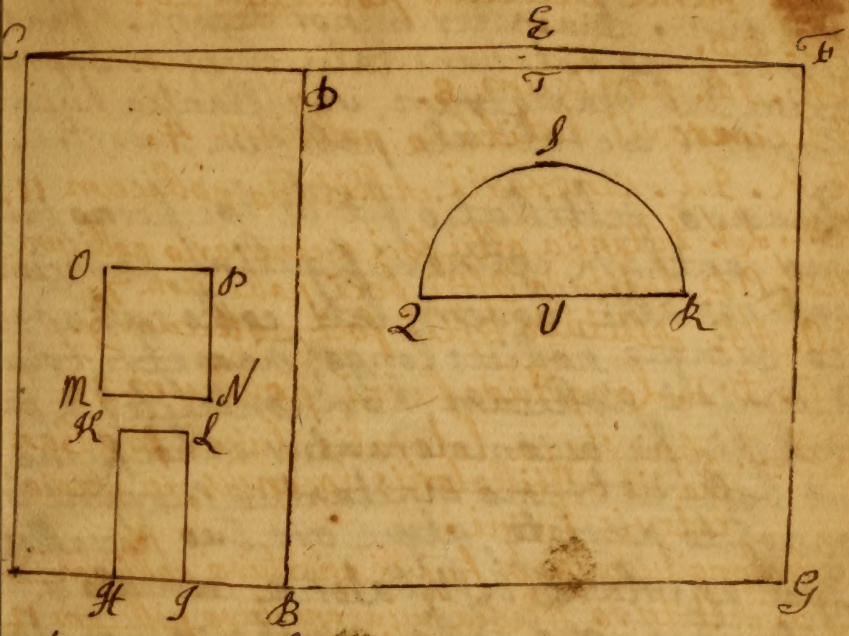
in anteriore parte hujus foci, ad altitudinem duo=rum pollicum supra cra=ticulam, fieri debet osti=um latum 5 pollices, 6 ex autem altum, supra formi=catum arcu ex magno circu=lo, diametri 12 pollicum.

ad pollicem supra for=nicem ostii fiat foramen conicum in fundo apertum diametri 2 pollicum; ut per illud introspici queat.

Fiatque operculum simi=lis figuræ. fiat hic fundus de bonis lateribus rectis 5 digitos crassis.

A B. Furni latitudo pollicum 20.
A C. B D.
A H. I B. pollicum 8.
H I. cinerarii latitudo pollicum 4.
H K. I L. cinerarii Altitudo pollicum 11.
K M. L N. Distantia ostii foci a cinerario pollicum 3.
M N. O P. Latitudo Ostii foci pollicum 7.
M O. N P. Altitudo Ostii foci pollicum 9.
E G. F H. Longitudo furni pollicum 38
Q R. S. Apertura lateralis furni pro Cantharis deftillatoriis locandis, in medio lateris furni.
Q S. Longitudo limbi hujus apertura pollicum 20.
V S. Altitudo Media hujus apertura pollicum 12.
S T. Craffities muri Superioris furni pollicum 6.

Supra pavimentum officina, Sub camino, erigatur parallelipipedum, latitudinis anterioris viginti pollicum, longitudinis pollicum triginta octo, Altitudinis undecim pollicum. Cavitatis autem latitudo anterior duodecim pollicum, longitudo pollicum viginti duo: unde muri craffities Sponte patet. Deinde hic ponuntur ferramenta pro craticula, prismatica, pollicem lata, longa quatuordecim pollices, in distantia pollicis, Situ ad latitudinem cinerarii parallelo. Tum fiat Ellipsis descripta Supra cavum Superius hujus parallelipipedi, cujus foci distent 22 pollices, diameter minor Sit duodecim pollicum, eritque fere latitudo in principio, & fine foci decem pollicum; tum construatur elliptica hac forma cavitas quatuor et dimidii pollicum interne, & compleantur exteriora



exteriora in forma parallelipipeda.

limen ostii foci infimum debet declive
esse interiora versus declinatione unius
pollicis & dimidii, quod ostium porta ferrea
versatili exacte claudi posse debet.

R.V.k. sit decem pollices supra craticulam
2 I k. fornix ellipticus, cujus foci distent 20
pollices, diameter minor 24.

In pariete interno opposito huic aperturae
altitudinem novem pollicum supra cra-
culam, est margo sesquipollicem eminens
sustentanda vasa pro destillatione.

muro opposito aperturae destillatoriae
premo, fiat foramen liberum, quadra-
m, pro camino, tres pollices latum, duos
ltum. Tum fiat fornix superior fornaci
lipticus, ita ut medium punctum lacunari
nicati distet a craticula 21 pollices.

Diamet

diameter ellipsis sit vigenti & duorum pollicum. diameter minor decem. fiat fornix ergo rotatione talis ellipsis supra axim seu diametrum, in distantia hujus diametri a cratícula pollicum sedecim.

Quando destillatio fit de hac furno, tum duo cantharí cylindrí figulini, undecim pollices alti, novem lati, collo cylindrico quinque pollices longo, diametri trium & dimidii pollicum, horizontaliter & paralleli, sic accommodantur in hoc furno, ut basis extremo innitantur margini in opposito pariete, atque ore suo paralleli sint aperturæ destillatoriæ cemento & lateribus circa colla cantharorum clauditur perfecte tota hac apertura. ori cantharí committitur segmentum cylindricum, & huic applicatur recipiens.

37/98 Sal volatilis alcalinus acido perfecte saturatus, augetur ad $\frac{37}{98}$ ponderis priorís. T.II. p. 321

Spt. Sal. Ammon. cum calc. viva
Sal. Am. tritus solvatur
aqua pura triplo & superfunde calci vivæ
respecta Sal. triplo, fiat lenté destil.

Sal volat. Ammon. cum Alc. fixo
Sal. Amm. p.x. Sal. tart. p.3. misceantur
fiat Sublimatio

Spt. S. Ammon. cum alcali fixo.
Salis Ammon. p.x. Sal. tart. p.3 Aquæ p.5.
destillatus ad siccitatem, fiat Sol. Salvatellinus